THE NATIONAL GEOGRAPHIC MAGAZINE

Vol. XIII JUNE, 1902 No. 6

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VOL. XIII, No. 6 WASHINGTON JUNE, 1902

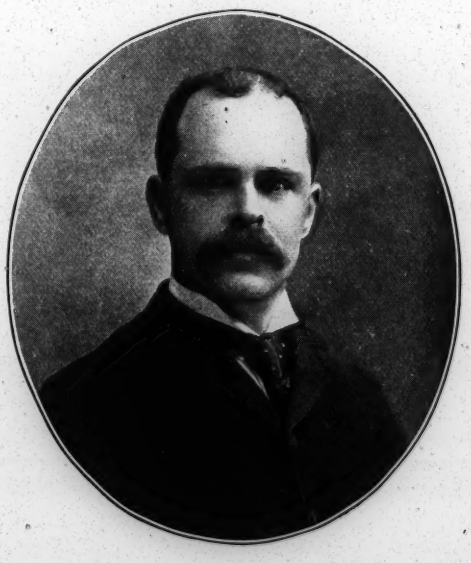
THE NATIONAL GEOGRAPHIC MAGAZINE

THE NATIONAL GEOGRAPHIC SOCIETY EXPEDITION TO MARTINIQUE AND ST. VINCENT

THE National Geographic Society has sent three of its members on a special expedition to Martinique and St. Vincent to investigate the volcanic conditions of the West Indian regions. The distinguished scientists who make up the party are: Robert T. Hill, of the U. S. Geological Survey; Israel C. Russell, professor of geology in the University of Michigan, Ann Arbor, and Commander C. E. Borchgrevink, the Antarctic explorer, who has studied the volcanoes Erebus and Terror, the most southern volcanoes known on the face of the globe.

The expedition is the most important and best equipped commission ever sent out to study actual volcanic action. Results of great scientific and practical consequence may be expected to flow from their work. On their return to the United States they will report the results of their observations to the Society. This report, forming a series of illustrated articles, will be published in full in the journal of the Society, the NATIONAL GEOGRAPHIC MAGAZINE.

The expedition sailed from New York May 14, by special permission of President Roosevelt and Secretary Moody, on the *Dixie*, which carried the supplies bought with the $200,000 voted by Congress for the aid of the West Indian suf-



Robert T. Hill, Geologist

Member of the National Geographic Society Expedition to Martinique

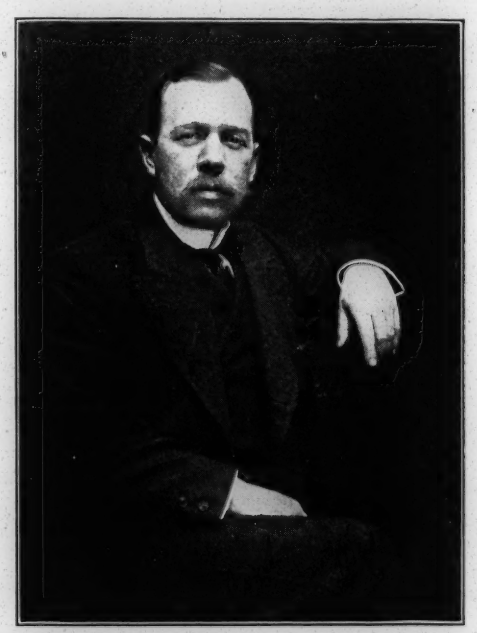
ferers. They arrived in Fort de France Wednesday morning, May 21, several hours after the second great eruption of Mount Pelée, which in violence exceeded the explosion of May 8.

In placing such a competent expedition in the field so promptly the National Geographic Society is rendering science and the advancement of knowledge a great service. It is most important from a scientific point of view that the general volcanic activity now devastating Martinique and St. Vincent and disturbing the West Indian region should be studied by specialists at the earliest possible moment. Not in history has such a favorable opportunity occurred for an investigation of the causes of volcanic and seismic action, of those hidden forces which, smothered in large measure in the bowels of the earth, occasionally burst forth with old-time fury and make or unmake great masses of land.

The most recent volcanic explosion of modern times, the explosion of Krakatoa in 1883, took place thousands of miles from the center of the world's scientific workers.

But in the present activity of Mount Pelée, of La Souffrière, and the uneasiness general throughout the Lesser Antilles, the scientists of the United States have a unique opportunity for investigation. The United States Government has no authority to expend money for scientific investigations in foreign territory. None of the scientific branches of the government, as the U. S. Geological Survey, was therefore in a position to send an expedition to Martinique. But the National Geographic Society, recognizing the importance of immediate investigation, has sent to the region of disturbance, at its own cost, three of the foremost authorities on volcanic action in the world.

Mr. Hill is well known as the author of "Cuba, Porto Rico, and the Other Islands of the West Indies" (The Century Co.) and numerous articles and government reports on the geography and geology of the West Indian group. He visited Martinique and St. Vincent several years ago. Dr. Russell is the head of the Department of Geology in the University of Michigan and the author of "Volcanoes of North America," a standard work on the subject.



Commander C. E. Borchgrevink

Member of the National Geographic Society Expedition to Martinique

RECENT EXPLORATION IN THE CANADIAN ROCKIES*

By Walter D. Wilcox

PART II

WE decided to spend August 13 in an attempt to learn more about the surrounding region and for this purpose selected a high mountain north of our camp for ascent. Fortunately the weather was perfect. The entire forenoon was spent in climbing this peak, which turned out very interesting. The heavy bush was wet from the previous day's rain, and we were soaked in the first hour. On the higher slopes some very interesting fossil corals and shells were found. The summit, 8,780 feet high, was reached before noon. Both Bryant and I took angles and made complete photographic panoramas of the view, which was superb. The result of this climb made us more certain that we were approaching the Elk River, as the mountains toward the east resembled Dawson's description of them and ran in the right direction The valley below our camp apparently enters the Elk ten miles or so to the southeast, but a better route appeared over a pass to the north. On the open and flat summit of this mountain two species of butterflies were seen and several flowers, among them a bright yellow erigeron and a leguminous plant closely resembling a violet in general outline.

Lusk and Wood had been sent to explore the lower part of the valley and were back when we reached camp. They said they had gone down to where a large stream comes in from the north, and had found a good trail ascending the latter. They brought in a canvas-back duck, which proved very tender and fine-flavored. In the afternoon, with the assistance of Woodworth, our best axeman, I laid out a base line half a mile above our camp to triangulate my survey stations. At night I changed two dozen plates for my cameras under a dark-room teepee made of blankets thrown over poles. The rapidity of our movements and the continuous fine weather, of which we took advantage, gave no time for rest or repose.

The next day we made a rapid and uninterrupted march of four hours. After five miles through green timber we reached a wide meadow, much used by the Indians as a camping ground. Here we turned at right angles, to the left, and marched four miles upstream and camped near the base of what we thought was a pass to the north.

Tom Lusk went up the valley to locate the trail for the next day's march, but came back an hour later and said there was only the faintest kind of a trail a mile above camp, while a little farther on it totally disappeared. With our field-glasses we could see no sign of a trail on the pass ahead, and, as we knew from the previous day's climb that this was the only possible outlet, it seemed that we had marched into a "blind valley," or cul-de-sac. Indian trails rarely ascend such valleys unless the region is exceptionally good for game. After this discouraging news I set out to learn a little more, if possible, and, instead of following the valley, commenced a gradual ascent of the slopes on the east. After an hour's climb I got a fair view of one of the two

*The first part of this very interesting paper by Mr. Wilcox appeared in the May number.

Photo by Wilcox

Second Range West of the Elk

lakes which Tom said he had seen at the end of our valley. Though I went on for another half hour, I could not see the other lake, owing to an exasperating ridge which remained in the way. It was now so late that I was forced to return by way of the valley. The lake is apparently very beautiful, as four high connected peaks lie behind it and are flanked by glaciers at their bases. The lake is surrounded by woods and cliffs, which on the north side rise out of the water abruptly. I regretted that it was impossible to visit that interesting spot, but it was now so late that I had to return to camp on account of darkness.

The atmosphere was so clear in the night that three satellites of Jupiter could be seen with our field-glasses. In the morning there was much frost and ice and a conspicuous absence of "bull-dogs." It seems remarkable that the mountain plants and delicate flowers are not injured by temperatures below the actual freezing point, not only here, at altitudes of 6,000 feet, but even 2,500 feet higher, at the upper limit of plant life, where the cold is far more severe.

For the first time on our trip a retreat was necessary, and we marched rapidly back to the junction of the two streams.

Photo by Wilcox

Camping in the Elk Valley

Shortly beyond this the flat, meadowy character of the valley ends, and the trail ascends one of two curious moraine-like ridges which descend into the valley on either side and seem to make a kind of dam. Crossing this, we were soon in a wild gorge, with a roaring torrent below us and magnificent spruce trees of great height on every side. This change from the quiet stream and open meadows was one of those sudden

and surprising transformations that add so much to mountain travel. The trail turned more and more toward the east and northeast, through the finest timber I have ever seen in this range. Many of the spruces were not less than one hundred and sixty feet high. Unfortunately, the ground was covered by many fallen forest giants too large for the Indians to cut out, and the trail made such a number of turns that our horses could be seen going in different directions several times in the length of our procession. After six hours of tiring march, a rapid descent brought us to the bottom of a wide valley with a deep stream flowing south. This we knew from Dawson's map and description to be the Elk River. After fording the river our camp was placed in a delightful meadow. Bryant caught two trout before lunch was ready, and these were the first fish we had seen in many weeks. In the afternoon enough fish were caught to supply the entire party with dinner and breakfast.

This part of the Elk River has been described by Dawson. It is very wide and flat, with a number of meadows interspersed among burned forests. The valley in the meadows by the river and in the occasional spots of green forest is picturesque, but otherwise the vast waste of burned timber and the monotonous and uniform mountains on either side have a desolate aspect.

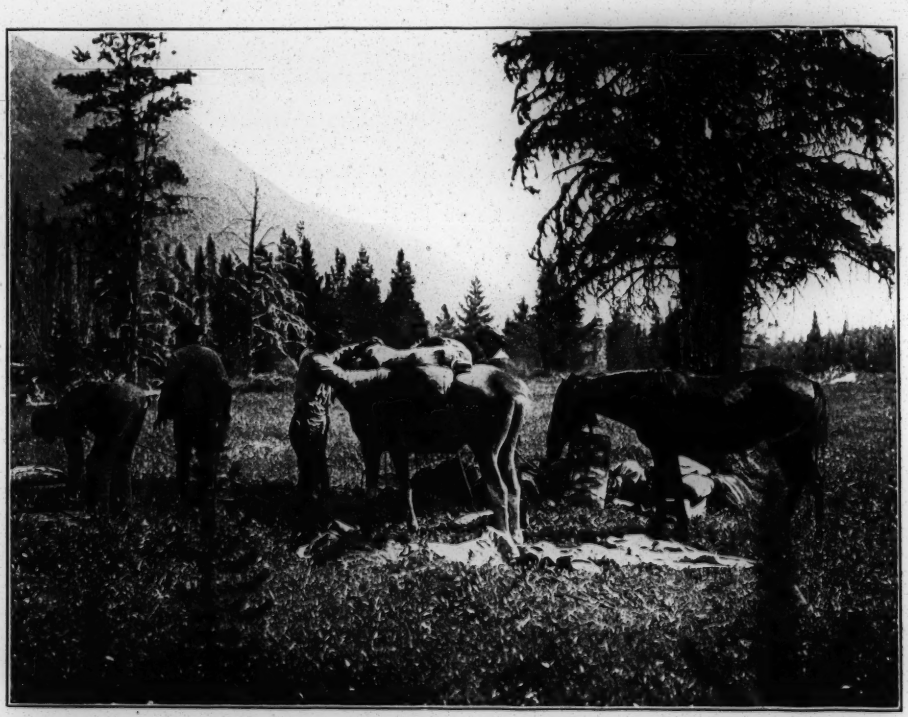


Photo by Wilcox

Making Camp After a Hard Day's Journey

The following day was warm and quite smoky from forest fires. We made an uninteresting and fatiguing march of six hours to the divide between the Elk and Kananaskis Rivers. The fallen timber and obscure trail gave us very

much trouble, and we could only make one or two miles an hour by having two axemen ahead to cut timber constantly. We camped near the pass which, according to our aneroids, is 6,440 feet, or sixty feet lower than Dawson's estimate.* Exactly opposite the pass on the west is a large gap, from which the source of the Elk River, a large and muddy stream, comes into the broad and nearly straight depression, forty miles long, occupied by the upper Kananaskis and Elk Rivers. I was anxious to explore this, but three miles of impassable timber intervened, and this region was postponed till after the Kananaskis Lakes were reached.

The next day was warm, and we were annoyed by numbers of mosquitoes and small black flies, which rise in swarms from the grass and bush. They are not so bad till the bush is shaken, and consequently those in front of the procession suffer little, while those in the rear can hardly see or breathe at certain times. I found three mosquitoes on different occasions carrying the pollineum of some kind of orchid, probably one of the common species found in every swamp, attached to the head. No doubt these mosquitoes had been imitating bees or other insects by drawing nectar from the blossoms.

It required nearly six hours to reach the Kananaskis Lakes, which we first saw from a wooded ridge three or four miles distant. Camp was placed on the large river connecting the two lakes. It was with not a little pleasure that we settled ourselves at length on the shores of these lakes after fifteen days marching to reach them. Here for the first time our folding boat was set up for the purpose of exploring and fishing trips. It looked frail, but we found it to work well and capable of holding three men safely. Bryant succeeded in catching a number of fine trout in time for dinner.

* For map see p. 167, May, 1902, NAT. GEOG. MAG.

Our camp was picturesquely located on a wooded bank of the river, which has a large volume of water and is perfectly clear. The neighborhood seems to abound in every kind of game, and made an acceptable change from the comparatively lifeless region which had recently been traversed. Wild ducks and geese flew constantly by our camp, using the river as a route between the two lakes, and several flocks of ducks were constantly visible on the lake from our camp. The bottom of the lake near the shore is covered by several species of water plants, whose long stems wave gently in the current of the inlet stream, and the surface of the water is constantly ringed by trout rising to flies. We were startled at evening and after nightfall by the melancholy cry of the loon, the hooting of owls, and other mysterious sounds made possible by lynxes or mountain lions.

A week was spent at the Kananaskis Lakes, in which our time was very fully occupied in survey work and exploration of the surrounding region. On the second day we moved camp to the upper lake, which is not half a mile distant. It is 60 feet higher, and separated from the lower lake by a long rock ridge. From our tent we looked out on a revelation of beauty hardly equaled anywhere in the mountains. This lake is pear-shaped and about two miles in diameter. It is encircled by very high mountains of the main range of the Rockies, and has four large islands and several small islets, all densely wooded, which give an endless variety of view from various points. The water is perfectly clear, but not very blue, like most mountain lakes, and the shores, where not abrupt, are lined with a black shaly gravel. No fish were ever seen or caught in this lake, while the lower lake abounds in them.

I had planned for a trip to the Kananaskis Pass on the 20th in order to learn its location, altitude, and other

Photo by Wilcox

"Our camp was pitched on a wooded bank"

interesting details. This seemed the most important piece of work near the lakes, especially as nothing is given on Dawson's map except a reported altitude of 6,200 feet and the presence of a lake draining west on the top of the pass. These details were taken from Palliser's narrative, written half a century ago. The fact that he was probably the last if not the only white man to have crossed this part of the Rockies, to say nothing of a desire to see at what point on our way down the Palliser River we had overlooked the pass, made me very anxious to explore that region. Bryant, who was enjoying fine fishing every day in the lower lake, did not care to join in this trip.

Unfortunately the weather of late had been giving every indication of an approaching storm, the air being warm and smoky, with heavy fogs in the early mornings. On the appointed day we were awakened by thunder in the mountains west of us, and not long after dark clouds settled over the lake and brought rain. We were compelled to wait till 9 o'clock before there was enough promise of good weather to warrant a start. It was perhaps imprudent to attempt to reach the summit of a great pass and return to camp in one day, especially after a late start and in bad weather. I took Jim Wood with me, a half-breed who acted as our second packer, and two saddle horses, one of which had first been with me on a trip up the Bow River six years before. We carried a small camera, an axe, and various instruments for rough survey work, besides a lunch of bannock and canned meat. The trail first skirts the lake on the north shore, and then turns west into heavy timber. The woods were dripping and a drizzling rain kept falling, but we made fair time except for a few logs which had to be cut out. This was miserable, cold work and meant

Photo by Wilcox

Upper Kananaskis Lake Looking Toward Pass

getting wet in spite of long rain coats, as we had to tie or hold our horses each time for fear they would escape and go back to camp to join the other animals. Nothing is more trying to Indian ponies than separation from their associates, especially after they have been long together. About one mile from the lake we came to a meadow and forded the river which comes from the pass. This was the first time we had seen the Kananaskis before it enters the lake, and we were surprised at the considerable volume of water. It is muddy and of that peculiar color we had seen in the Palliser. The valley soon became narrow and wild, with a rough trail ascending a wooded ridge. Here the stream banks have been undermined and the trees thrown into the water. This made a partial dam and forced the river to undermine further, continuing the process, so that there were several acres of fallen timber in the stream bed. The trail itself had been washed out and ended in a place where, from the depth and swiftness of the current, it was impossible to touch bottom with poles. We had to find another place, and at length came out on an open gravel wash and easier travel. The pass is here most imposing.

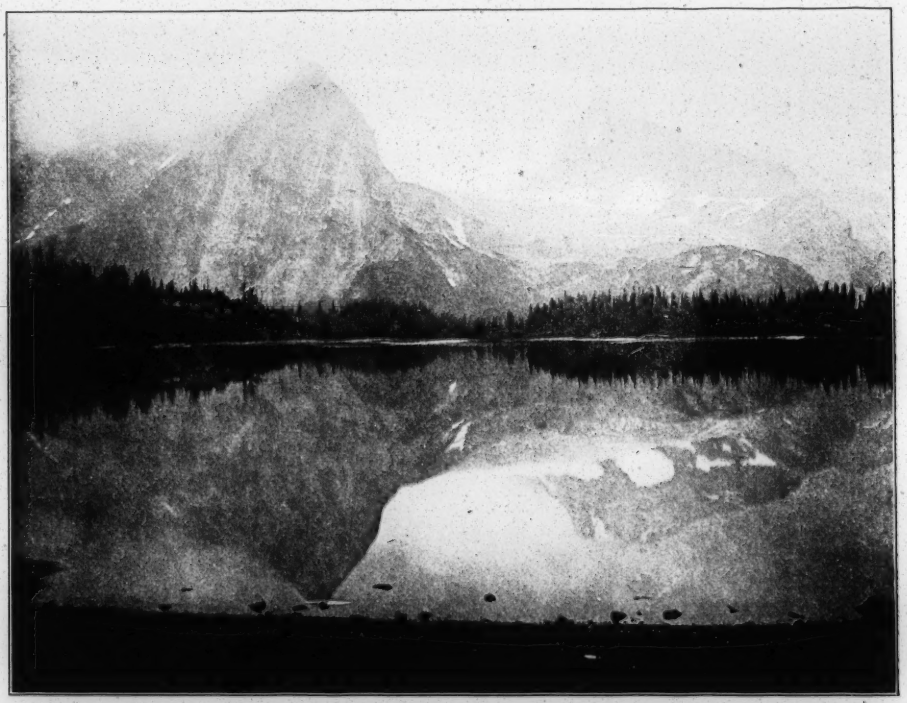


Photo by Wilcox

Named by Mr. Wilcox "Lawson Lake"

We were surrounded by very steep and craggy mountains, their tops covered by clouds, while the green forests below were partly concealed by clinging mists rising from the saturated ground. The swift rush of the river and the occasional rumble of thunder, echoing among the cliffs, added to the impressive grandeur of our surroundings.

The trail turned at length to our right or to the north. This development took

away our hope that the pass lay near us to the west. After three hours' hard travel we were not 300 feet above the altitude of the lake, and were turned north in a long valley parallel to the summit range. It now seemed very unlikely that the summit could be reached that day, but the trail soon made a sudden and unexpected ascent of the slope on the west side of the valley. After a tedious climb of 1,300 feet, we reached the end of a short valley with a steep glacier at the end partly covered by coaly-black shale. No outlet for a pass was visible. The trail then led across the valley stream and over a ridge, where we had lunch by a small lake.

The clouds now began to lift a little. Leaving Wood to attend to the horses, I hurried off to cross a ridge half a mile ahead, which I thought was the summit of the Kananaskis Pass. As five hours had been spent in reaching this point, I told Wood that I would be back in an hour, as that would only leave us enough time to reach camp before nightfall. Shortly after leaving Wood I saw a beautiful lake through the larch trees. Some rugged mountains beyond were reflected in its surface, which lay like a vast mirror in the calm air. Here I made sketches and took photographs. Then, after leaving the field-glasses on a scrubby spruce, out of the way of picas and marmots, which were squeaking and whistling on every side, walked rapidly to the other end, thinking this was the lake reported by Palliser on the summit of the pass. There was no visible outlet to the lake. Its waters sink underground somewhere, though a dry channel leads out at the north end and the lake shores show that the water level is sometimes several feet higher.

The trail seemed to descend into a depression toward the north, but I now suspected that this was not the pass summit. My time was now exhausted, and though a cold night in wet woods was risked I felt the necessity of determining whether this was indeed the highest point. Feeling the need of making fast time, I left my camera and coat on another bush and started on a trot down the trail. Here, in five minutes, the trail came to a small stream and turned sharply to the west, toward a pass which I roughly estimated to be 8,000 feet high and so far away as to mean an hour's hard work.

Failure to reach the Kananaskis Pass now seemed more certain than ever. In spite of prudence and the warning of my watch, I felt that too much was at stake to give up reaching the summit now. The cool air was exhilarating, but one can not long continue violent physical exercise at 7,000 feet above sea, especially on a rough and ascending trail. I recall splashing through an icy stream, and then a half-mile run through a hummocky meadow, where I caught a swift glimpse of a glacier and its huge morainal stones on my left; finally the steep and heart-breaking ascent of a narrow ravine, where a pretty rivulet was hushed under banks of snow. The last Alpine flowers, the rushing streams, and the whistling marmots of the upper meadows were left behind, and I approached a barren ridge. Looking over this, I saw a desolate lake surrounded by bare cliffs and the awful solitude of that half-way belt which has neither the beauty of the green valleys nor the grandeur of great snow-fields. I ran along the muddy shores and through snow banks to the other end; then, ascending to the crest of a ridge at 7,805 feet, stood on the top of the Kananaskis Pass at 4 o'clock. There was, besides the flush of exercise, something impressive in the wild solitude of that barren place, of the gloomy sky overhead, and the vast outlook on an unknown wilderness. Hither none, except perhaps the Indian, had come since Palliser, fifty years before, and even

now, outside of our little band at the lake, probably no white man was nearer than twenty miles in any direction. Here I looked down into a desolate valley 2,500 feet below, where a muddy stream coming from a high peak north enters the Palliser River. I recognized the location of our first camp in the Palliser, where, in the maze of burned timber and side trails of an Indian camp, we had overlooked the Kananaskis Pass. After ten minutes on the summit, I commenced a rapid return, running and walking to the first lake. The clouds had lifted on the high mountains to the north, revealing a very large glacier. In the golden light of evening, for the sun was breaking through the storm, the lake resembled a great mirror, and the clouds were rolling over the cliffs and assuming fantastic forms. Even in my haste to gather up the various articles left here, I appreciated that rarely or never had I looked upon a more beautiful scene. I named this Lawson Lake.

It required an hour to reach Wood and the saddle horses. We started at 5.15, and made a desperate effort to reach camp before nightfall. Running our horses wherever possible, and they were more than willing to return, we reached camp in three hours, just as night appeared. Two Stony Indians were standing by our camp fire as we approached.

Bryant said he had spent an interesting day, and while fishing in the lower lake had seen a long file of Indians coming down the north shore. They shouted, "Come here." Feeling certain that they were Stonies, a very friendly tribe, he visited them without fear. The canvas canoe, his silk fishing lines, and wonderful display of artificial flies excited their utmost surprise and admiration. An old man conversed with Bryant through one of the young bucks as interpreter. The latter receive a good education at the schools on the reserve at Morley. Some of the conversation was as follows:

"Where you come from?" "Banff." "How many in your party?" "Five." "You catch many fish?" "A few." "Old man says this is Stony Lake. No like it white man catch fish here." To this Bryant replied that he would catch as many as he wanted to eat.

"You shoot goat?" "No." "You shoot sheep?" "No." "You shoot elk?" "No." "Bear?" "No." "What you shoot?" "Nothing. We came here to see the country." At this there was a shout of derisive laughter and loud talking for a long time. Later three of the Indians came up to our camp and had dinner, but Ben Woodworth said it was almost impossible to fill them up, and that there would have been nothing for us if he had given them all they wanted.

The Indians told us that the pass visited that day was the Kananaskis, and that it was two "sleeps" to the Kootenai, by which they mean the Palliser River or any stream on the other side of the divide. The Stonies, so far as I have been able to find out, have no local names for anything except the great passes, and these names they have adopted more or less from the white man. That we had covered the equivalent of three days' travel in eleven hours shows how rapidly we had traveled.

I tried to get some information from the most intelligent of the young bucks, but without much success. They said there was a lake a mile or two long in the next valley to the south, the head of the Elk, which we had not visited. They knew of the high pass which we had crossed on August 12, and expressed the greatest surprise that we had gotten our horses over it. The Indians were disgusted that we had shot no game, and that we were at the "Stony Lake." This term they apply only to the long lower lake, which is full of fish, and

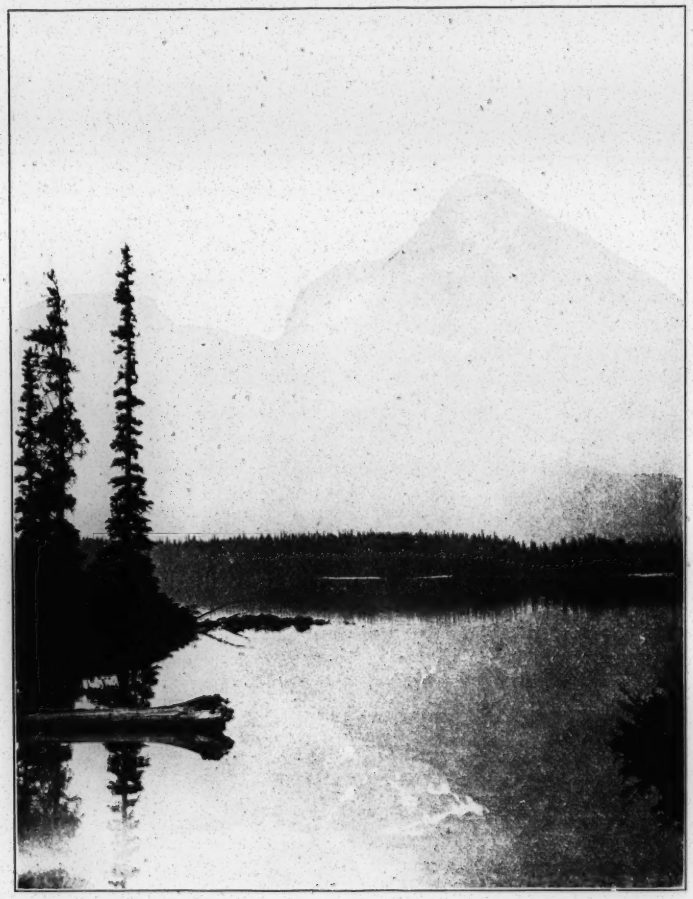


Photo by Wilcox

Storm on Kananaskis Lake

said we could have the other, which has none, but is far more beautiful. There is no beauty or grandeur in the mountains for them, where they suffer cold and privation only to fill their flesh pots.

The next morning about 9 o'clock the whole troop filed by our camp, which was placed almost on the trail. There were about twenty or thirty Indians and about fifty horses in their outfit. The oldest men came first, then the young bucks. Later came the squaws, many of whom had papooses strapped on their backs or placed in the saddle just behind the high Mexican pommels. One little child, not four years old, was fastened in a kind of basket on a gentle pony and allowed to shift for himself. Many of the bucks said, "Good morning," or saluted in some way, but most of the women looked straight ahead, as though we were not visible. The younger girls were evidently embarrassed, but the old squaws made remarks and were interested in our teepee, which no doubt partially won their hearts. All the women drove two or three ponies each, some of which were running loose, and others curiously

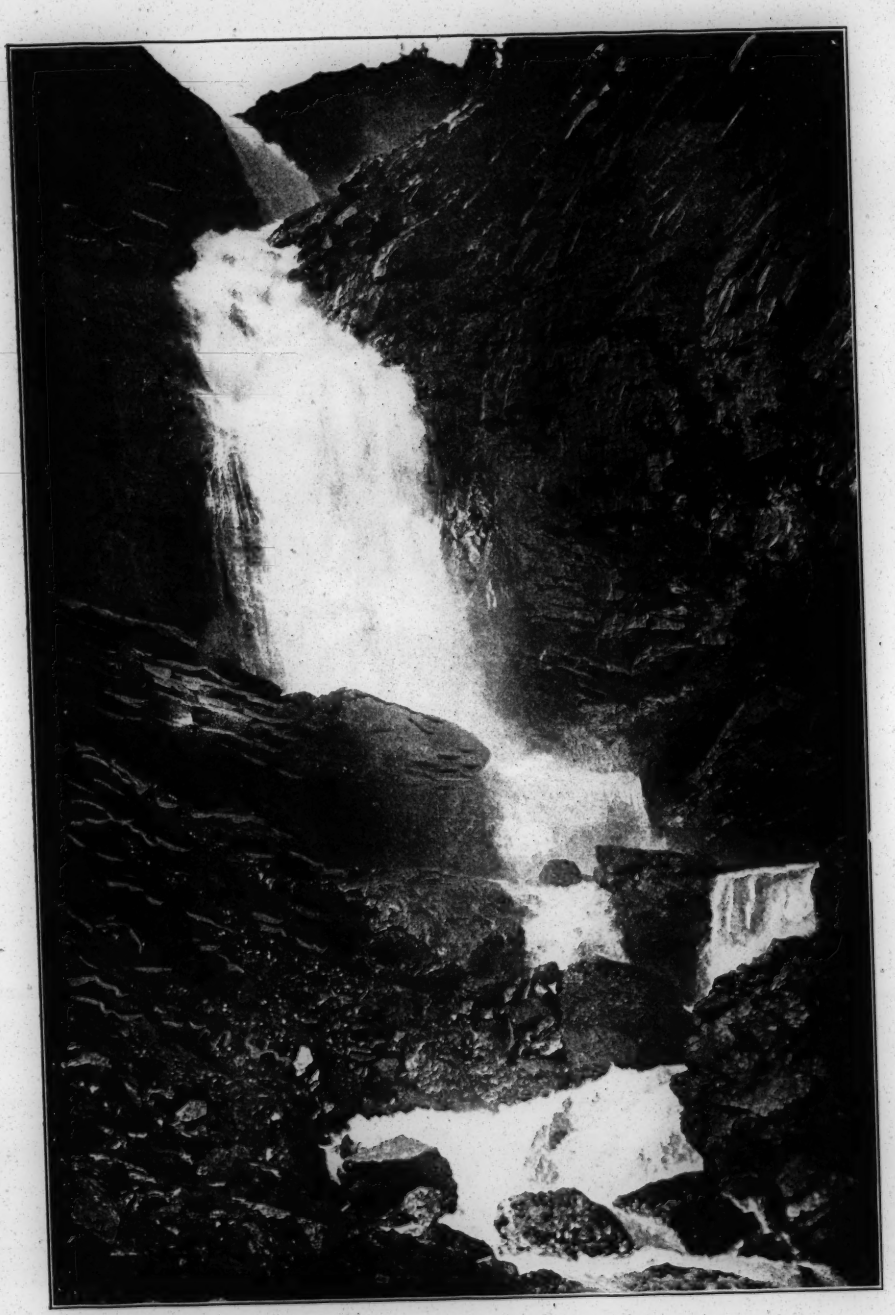


Photo by Wilcox

Falls Near Kananaskis Lake

packed with skins of wild animals and leather thongs. They speak very quietly, or make a gentle, hissing noise to their horses, when they go wrong, as they all did at suddenly seeing our camp. This manner of driving is entirely different from the vociferous shouts and curses of the average white packer. Fully fifteen minutes elapsed while this interesting procession was passing.

The canvas boat had been carried to the upper lake, where we were now located. After several preliminary excursions, Bryant and I made a visit to a valley directly across the lake. Our chief object was to see a large waterfall, which, though fully four miles distant, could be easily seen and heard from our camp. Our course down the lake lay between some heavily wooded islands, and as the water was perfectly calm the views on every side were most attractive. The other side was reached after 35 minutes steady rowing, and a landing was made near where the Kananaskis River enters the lake We were drawn a little out of our course by hearing the sound of falling water coming mysteriously from a densely wooded bank. Here a curious spring bursts out of the ground and discharges enough water to make a fair-sized stream. To ascend the valley we had first a ridge to cross, involving a climb through an almost impenetrable forest. With our heavy cameras and other necessaries it was exceedingly trying work, pushing aside stout, young trees, crawling under logs or over great windfalls, all so closely set together as to resemble a hedge. After half an hour of this we reached the top and were descending the other side when a lake appeared below. Though surrounded by woods, the trees all ceased to grow at a level about 20 feet above the water, and the intervening space was thickly overgrown by cow parsnips and tall grasses. Across this sheet of muddy water a large stream could be seen foaming into the lake from a canyon. Skirting the shore, we followed a kind of trail made by elk through a dense wood. In half an hour we were well up an open valley into which the falls plunge. Though the volume of water in these falls is large, we were somewhat disappointed by their height, which, according to an estimate by aneroid and level, is only 150 feet.

While I was photographing, Bryant had nearly reached the top of the cliff by a narrow couloir. Thinking he intended to explore the upper valley, I followed, but upon reaching the top it was impossible to follow his tracks in the heath-like moss and through open woods The country was park-like, but many limestone ridges and miniature cliffs, alternating with Alpine flower gardens, giving a wonderful display of purple asters and bright yellow erigerons, made progress slow. On one slope of broken stones I saw a great number of curious fossils, resembling a goat horn in appearance and lying loose in the debris. Similar ones were seen later embedded in almost every cliff, together with many fine coral fossils, one of which was 18 inches in diameter. Finding no accessible valley to the south, from which I had hoped to get a view into the unseen valley, where the Elk River heads, I turned west and found a lake half a mile long at the base of a long glacier. This mass of ice covers the north and west slopes of the high mountains east of the Palliser River which had caused us to travel so far south. One glacier is about five miles long. The lake rests in a basin of solid rock and the outlet stream rushes into a small canyon and is very swift and full of cascades all the way to the great falls which we had seen below.

A storm was coming up and I hastened back to the falls, which were reached in an hour. Here I saw Bryant on the opposite side of the stream trying to

cross the canyon by building a bridge of logs. All but one fell short, and I advised not trying to cross here, as it was a terrible place to slip. Thus we had to travel on opposite sides all the way to the first lake we had discovered. Here I built a fire to keep warm while Bryant made a rough passage over the cliffs on the opposite side and finally appeared at the lake, having found a log jam above.

This lake has no outlet, though an ancient channel serves as an overflow in time of flood. Thus the trees cease to grow at the certain level where the outlet allows no farther rise. We followed the canyon made by the former stream, and only after an hour of the most difficult bush work I have ever seen, we reached the lower lake at the great spring near which our boat had been tied. We now felt certain that this was one of the underground outlets of the upper lake.

That night the moon broke through the clouds and flooded the lake with soft light, bringing the heavily wooded islands into strong relief. From our tent door we could see, beyond the broad expanse of water, a grand picture of dark mountains inclosing a silvery ice field, and through the calm night air we could hear distinctly the falls we had visited that day with so much difficulty.

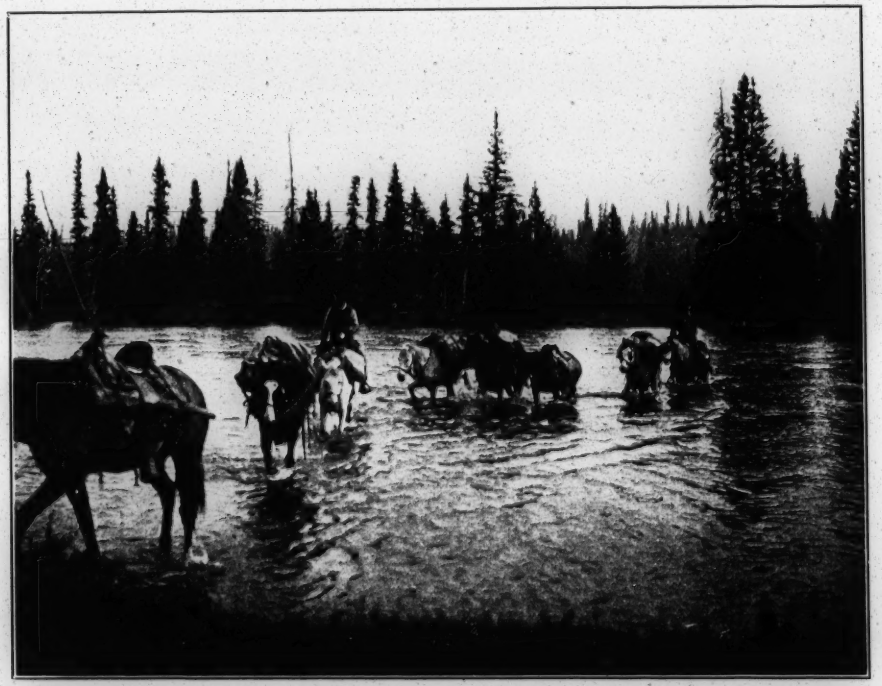


Photo by Wilcox

Fording the Kananaskis

The next day was to be our last at the Kananaskis Lakes, and was full of activity. In the morning I made a panorama of eight plates from one of the islands. Unfortunately most of this series, after escaping the perils of the wilderness and three or four hundred miles on the back of an Indian pony,

fell victims to the baggage-smasher on their eastward journey.

After lunch I carried my camera to the top of a mountain 3,000 feet above our camp, or 8,700 feet above sea-level. This peak lies north of the lakes and is comparatively easy of ascent. The entire east side is a steep grassy slope, which ends abruptly in a jagged edge of cliffs. Looking over this to the west, one stands on the sharp crest of a tremendous precipice of very unusual formation. It is no less than a perfectly smooth wall, which sweeps out of the valley in a magnificent curve more than 2,500 feet in height to the rough edge of the arête. This narrow ridge is crowned, far above tree line, by scrub spruce trees, gnarled and distorted by wind into weird and fantastic shapes. The dwarf Alpine flowers were also interesting. I found some golden rod in full blossom, with stems and flowers perfectly developed, not more than one and one-half inches high. Far more exceptional was the discovery of some *epilobium* (*latifolium*), a beautiful plant related to the fireweed of the lower valleys, at 8,500 feet altitude, which is almost 1,000 feet above previous records. The last part of the climb was more rugged, and involved several hundred yards along a knife edge at the summit. Two eagles were perched on the highest crag as I approached. A vast panorama, including the upper Kananaskis and Elk Valleys, with the Opal and Mist Mountains beyond and the main range of the Rockies on the other side, was disclosed from this peak and made a fine reward for the climb. The ridge crest was so narrow that I could not stand behind the camera, but had to focus and expose plates by a method adapted to such emergencies. Fortunately the wind, which was blowing very strong in the valleys, as I could see by the white caps on the lakes, was only a gentle and unusually warm breeze at this great height.

We left the Kananaskis Lakes to follow the river back to the railroad on August 24. Owing to a serious error in Dawson's map of this region, we lost nearly two days' time by following a wrong trail, which, after leading us through miles of muskegs and burned timber, brought us to a gap in the Mist Mountains, with no sign of a trail going down the Kananaskis. On the second day at noon we found ourselves back at our starting point, but satisfied now to follow the trail which the Indians had used. Our march down the Kananaskis was accomplished in three long days' march, the last 20 miles of which were much facilitated by the now disused lumber road.

The original plan of our exploration was reversed—first by the fact that the upper Spray Valley does not lead directly to the Kananaskis Lakes, as Dawson's map surmises, and then because we missed the opening to the pass itself later. This in nowise defeated our object, and undoubtedly the accident led us into as interesting discoveries as would have been otherwise possible.

After comparing a sketch of the country we passed through with Dawson's map of the region, on either side some interesting facts are disclosed. Among them it seems that the second valley we had discovered east of the Palliser, and which we entered on August 10, is probably not a tributary to the Elk, though we had first thought it was. Where we left this valley the altitude is 5,060 feet, or nearly 300 feet lower than the Elk at a corresponding point due east. The Elk Valley is known to have very little fall in that region, and it hardly seems possible that this river, which runs south eight degrees west, enters the former and has a still less descent. Moreover, in case there is such a gentle fall to the Elk, there should be an abundance of fish, which is not the case. I am inclined to think this is the source of the Bull River.

The actual time devoted to reaching and exploring this region, exclusive of our Assiniboine trip, was four weeks. The fact that not more than one-tenth of Dawson's "blank area" was investigated in that time, under every favorable circumstance of fine weather, competent men, and excellent outfit, gives an idea of the vast amount of work that still remains for future exploration.

THE ERUPTION OF KRAKATOA

By Sir Robert Ball

The following description by Sir Robert Ball of the eruption of Krakatoa will be read with special interest at the present time. It is taken from his book, "The Earth's Beginning," just published by D. Appleton & Co., and which is reviewed on another page of this number.

UNTIL the year 1883 few had ever heard of Krakatoa. It was unknown to fame, as are hundreds of other gems of glorious vegetation set in tropical waters. It was not inhabited, but the natives from the surrounding shores of Sumatra and Java used occasionally to draw their canoes up on its beach while they roamed through the jungle in search of the wild fruits that there abounded. Geographers in early days hardly condescended to notice Krakatoa. The name of the island on their maps would have been far longer than the island itself. It was known to the mariner who navigated the Straits of Sunda, for it was marked on his charts as one of the perils of the intricate navigation in those waters. It was no doubt recorded that the locality had been once, or more than once, the seat of an active volcano. In fact, the island seemed to owe its existence to some frightful eruption of bygone days, but for a couple of centuries there had been no fresh outbreak. It almost seemed as if Krakatoa might be regarded as a volcano that had become extinct. In this respect it would only be like many other similar objects all over the globe, or like the countless extinct volcanoes all over the moon.

In 1883 Krakatoa suddenly sprang into notoriety. Insignificant though it had hitherto seemed, the little island was soon to compel by its tones of thunder the whole world to pay it instant attention. It was to become the scene of a volcanic outbreak so appalling that it is destined to be remembered throughout the ages. In the spring of that year there were symptoms that the volcanic powers in Krakatoa were once more about to awake from the slumber that had endured for many generations. Notable warnings were given. Earthquakes were felt, and deep rumblings proceeded from the earth, showing that some disturbance was in preparation, and that the old volcano was again to burst forth after its long period of rest.

At first the eruption did not threaten to be of any serious type. In fact, the good people of Batavia, so far from being terrified at what was in progress in Krakatoa, thought the display was such an attraction that they chartered a steamer and went forth for a pleasant picnic to the island. Many of us, I am sure, would have been delighted to have been able to join the party who were to witness so interesting a spectacle. With cautious steps the more venturesome of the excursion party clambered up the

sides of the volcano, guided by the sounds which were issuing from its summit. There they beheld a vast column of steam pouring forth with terrific noise from a profound opening about thirty yards in width.

As the summer of this dread year advanced, the vigor of Krakatoa steadily increased. The noises became more and more vehement. These were presently audible on shores ten miles distant, and then twenty miles distant, and still those noises waxed louder and louder, until the great thunders of the volcano, now so rapidly developing, astonished the inhabitants that dwelt over an area at least as large as Great Britain, and there were other symptoms of the approaching catastrophe. With each successive convulsion a quantity of fine dust was projected aloft into the clouds. The wind could not carry this dust away as rapidly as it was hurled upward by Krakatoa, and accordingly the atmosphere became heavily charged with suspended particles. A pall of darkness thus hung over the adjoining seas and islands. Such was the thickness and the density of these atmospheric volumes of Krakatoa dust that for a hundred miles around the darkness of midnight prevailed at midday. Then the awful tragedy of Krakatoa took place. Many thousands of the unfortunate inhabitants of the adjacent shores of Sumatra and Java were destined never to behold the sun again. They were presently swept away to destruction in an invasion of the shore by the tremendous waves with which the seas surrounding Krakatoa were agitated.

Gradually the development of the volcanic energy proceeded, and gradually the terror of the inhabitants of the surrounding coasts rose to a climax. July had ended before the manifestations of Krakatoa had attained their full violence. As the days of August passed by, the spasms of Krakatoa waxed more and more vehement. By the middle of that month the panic was widespread, for the supreme catastrophe was at hand.

On the night of Sunday, August 26, 1883, the blackness of the dust clouds, now much thicker than ever in the Straits of Sunda and adjacent parts of Sumatra and Java, was only occasionally illumined by lurid flashes from the volcano. The Krakatoan thunders were on the point of attaining their complete development. At the town of Batavia, a hundred miles distant, there was no quiet that night. The houses trembled with the subterranean violence, and the windows rattled as if heavy artillery were being discharged in the streets, and still these efforts seemed to be only rehearsing for the supreme display. By ten o'clock on the morning of Monday, August 27, 1883, the rehearsals were over and the performance began. An overture, consisting of two or three introductory explosions, was succeeded by a frightful convulsion which tore away a large part of the island of Krakatoa and scattered it to the winds of heaven. In that final effort all records of previous explosions on this earth were completely broken.

This supreme effort it was which produced the mightiest noise that, so far as we can ascertain, has ever been heard on this globe. It must have been indeed a loud noise which could travel from Krakatoa to Batavia and preserve its vehemence over so great a distance; but we should form a very inadequate conception of the energy of the eruption of Krakatoa if we thought that its sounds were heard by those merely a hundred miles off. This would be little indeed compared with what is recorded, on testimony which it is impossible to doubt.

Westward from Krakatoa stretches the wide expanse of the Indian Ocean. On the opposite side from the Straits of Sunda lies the Island of Rodriguez, the

distance from Krakatoa being almost 3,000 miles. It has been proved by evidence which cannot be doubted that the thunders of the great volcano attracted the attention of an intelligent coastguard on Rodriguez, who carefully noted the character of the sounds and the time of their occurrence. He had heard them just four hours after the actual explosion, for this is the time the sound occupied on its journey.

We shall better realize the extraordinary vehemence of this tremendous noise if we imagine a similar event to take place in localities more known to most of us than are the far Eastern seas.

If Vesuvius were vigorous enough to emit a roar like Krakatoa, how great would be the consternation of the world! Such a report might be heard by King Edward, at Windsor, and by the Czar of all the Russias, at Moscow. It would astonish the German Emperor and all his subjects. It would penetrate to the seclusion of the Sultan at Constantinople. Nansen would still have been within its reach when he was furthest north, near the Pole. It would have extended to the sources of the Nile, near the Equator. It would have been heard by Mohammedan pilgrims at Mecca. It would have reached the ears of exiles in Siberia. No inhabitant of Persia would have been beyond its range, while passengers on half the liners crossing the Atlantic would also catch the mighty reverberation. Or, to take another illustration, let us suppose that a similar earth-shaking event took place in a central position in the United States. Let us say, for example, that an explosion occurred at Pike's Peak as resonant as that from Krakatoa. It would certainly startle not a little the inhabitants of Colorado far and wide. The ears of dwellers in the neighboring states would receive a considerable shock. With lessening intensity the sound would spread much farther around—indeed, it might be heard all over the United States. The sonorous waves would roll over to the Atlantic coast; they would be heard on the shores of the Pacific. Florida would not be too far to the south, nor Alaska too remote to the north. If, indeed, we could believe that the sound would travel as freely over the great continent as it did across the Indian Ocean, then we may boldly assert that every ear in North America might listen to the thunder from Pike's Peak, if it rivalled Krakatoa. The reverberation might even be audible by skin-clad Eskimos, amid the snows of Greenland, and by naked Indians sweltering on the Orinoco. Can we doubt that Krakatoa made the greatest noise that has ever been recorded?

Among the many other incidents connected with this explosion, I may specially mention the wonderful system of divergent ripples that started in our atmosphere from the point at which the eruption took place. I have called them ripples, from the obvious resemblance which they bear to the circular expanding ripples produced by raindrops which fall upon the still surface of water. But it would be more correct to say that these objects were a series of great undulations which started from Krakatoa and spread forth in ever-enlarging circles through our atmosphere. The initial impetus was so tremendous that these waves spread for hundreds and thousands of miles. They diverged, in fact, until they put a mighty girdle round the earth, on a great circle of which Krakatoa was the pole. The atmospheric waves, with the whole earth now well in their grasp, advanced into the opposite hemisphere. In their farther progress they had necessarily to form gradually contracting circles, until at last they converged to a point in Central America, at the very opposite point of the diameter of our earth, 8,000 miles from Krakatoa. Thus the waves completely embraced the earth. Every

part of our atmosphere had been set into a tingle by the great eruption. In Great Britain the waves passed over our heads, the air in our streets, the air in our houses, trembled from the volcanic impulse. The very oxygen supplying our lungs was responding also to the supreme convulsion which took place 10,000 miles away. It is needless to object that this could not have taken place because we did not feel it. Self-registering barometers have enabled these waves to be followed unmistakably all over the globe.

Such was the energy with which these vibrations were initiated at Krakatoa, that even when the waves thus arising had converged to the point diametrically opposite in South America their vigor was not yet exhausted. The waves were then, strange to say, reflected back from their point of convergence to retrace their steps to Krakatoa. Starting from Central America, they again described a series of enlarging circles, until they embraced the whole earth. Then, advancing into the opposite hemisphere, they gradually contracted until they had regained the Straits of Sunda, from which they had set forth about thirty-six hours previously. Here was, indeed, a unique experience. The air waves had twice gone from end to end of this globe of ours. Even then the atmosphere did not subside until, after some more oscillations of gradually fading intensity, at last they became evanescent.

But, besides these phenomenal undulations, this mighty incident at Krakatoa has taught us other lessons on the constitution of our atmosphere. We previously knew little, or I might almost say nothing, as to the conditions prevailing above the height of ten miles overhead. We were almost altogether ignorant of what the wind might be at an altitude of, let us say, twenty miles. It was Krakatoa which first gave us a little information which was greatly wanted. How could we learn what winds were blowing at a height four times as great as the loftiest mountain on the earth and twice as great as the loftiest altitude to which a balloon has ever soared. We could neither see these winds nor feel them. How, then, could we learn whether they really existed? No doubt, a straw will show the way the wind blows; but there are no straws up there. There was nothing to render the winds perceptible until Krakatoa came to our aid. Krakatoa drove into those winds prodigious quantities of dust. Hundreds of cubic miles of air were thus deprived of that invisibility which they had hitherto maintained. They were thus compelled to disclose those movements about which, neither before nor since, have we had any opportunity of learning.

With eyes full of astonishment, men watched those vast volumes of Krakatoa dust start on a tremendous journey. Westward the dust of Krakatoa took its way. Of course, every one knows the so-called trade-winds on our earth's surface, which blow steadily in fixed directions and which are of such service to the mariner; but there is yet another constant wind. We cannot call it a trade-wind, for it never has rendered and never will render any service to navigation. It was first disclosed by Krakatoa. Before the occurrence of that eruption no one had the slightest suspicion that far up aloft, twenty miles over our heads, a mighty tempest is incessantly hurrying with a speed much greater than that of the awful hurricane which once laid so large a part of Calcutta on the ground and slew so many of its inhabitants. Fortunately for humanity, this new trade-wind does not come within less than twenty miles of the earth's surface. We are thus preserved from the fearful destruction that its unintermittent blasts would produce—blasts against which no tree could stand and which would, in ten minutes,

do as much damage to a city as would the most violent earthquake. When this great wind had become charged with the dust of Krakatoa, then, for the first and, I may add, for the only time, it stood revealed to human vision. Then it was seen that this wind circled round the earth in the vicinity of the equator and completed its circuit in about thirteen days.

VOLCANOES

EONS ago the earth on which we live was a huge mass of "fire mist." Astronomers tell us that today in the heavens we can see vast nebula, suggesting what the earth was once. Gradually the surface of the "fire mist" cooled and hardened, but the interior is still intensely hot. Whether it is solid, liquid, or viscous we do not know. This heat, raging miles below the surface, at times escapes through the hard crust by vents or volcanoes.

There are from 300 to 360 volcanoes on the globe. This estimate includes merely live volcanoes and volcanoes which within recent times have been in action. If we should count the many mountains scattered over the earth which show today signs of volcanic action in more remote past the estimate would have to be increased by many hundreds.

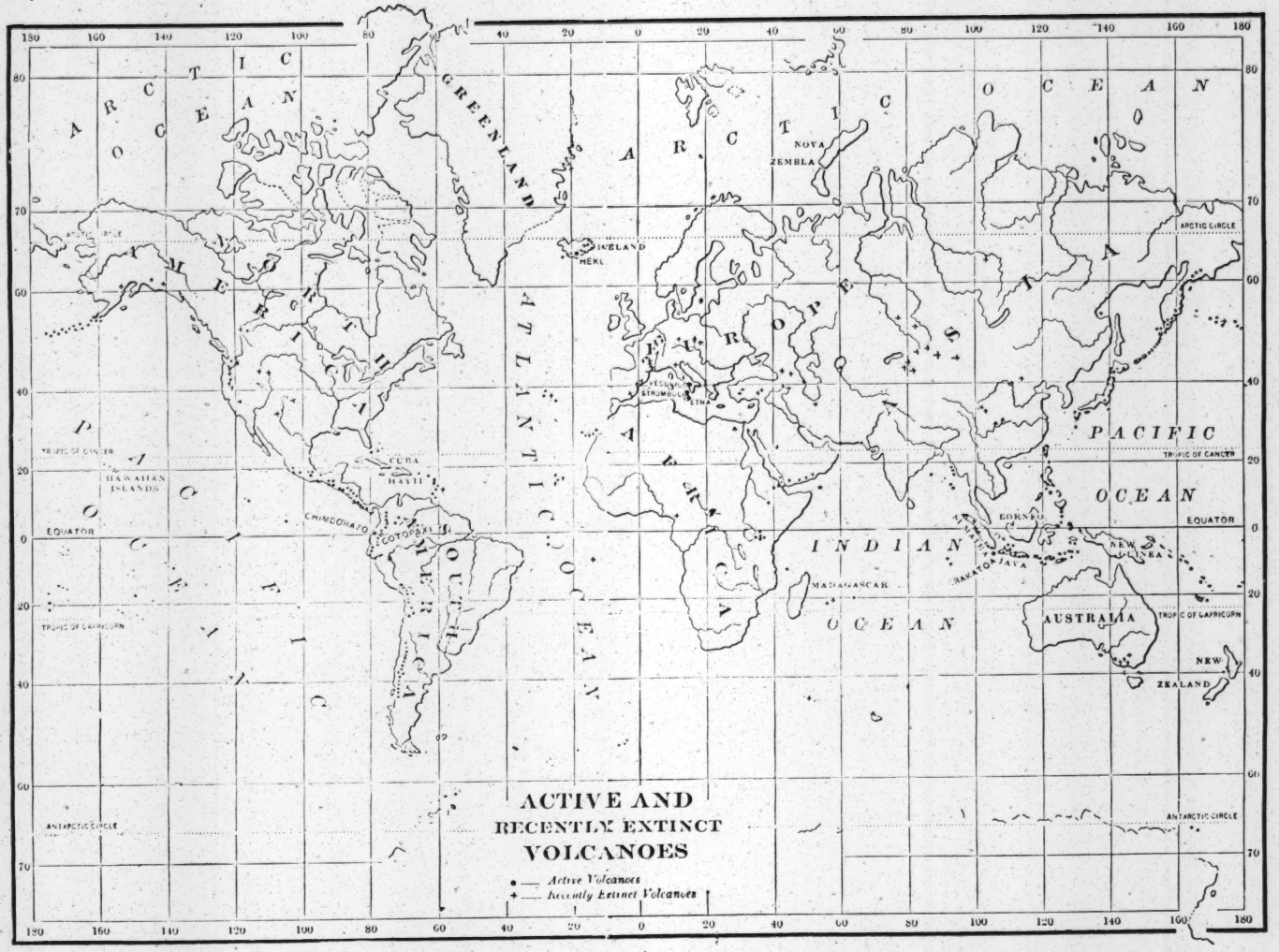
Volcanoes would seem to be arranged with more or less symmetry in belts circling the great oceans. A ring of fire surrounds the Pacific. Starting at the South Shetland Islands, several hundred miles south of Cape Horn, a belt of volcanoes extends up the west coast of South America, Central America, and North America; from Alaska it crosses the Pacific along the Aleutian Islands to Kamchatka; thence it follows the east edge of the Pacific through the Kurile Islands, Japan, Formosa, the Philippines, the Moluccas, the Solomon Islands, the North Hebrides, New Zealand, and finally ends in Mounts Terror and Erebus, on the Antarctic Continent. The volcanoes forming this great belt are in places ranged in chains, as along the west coast of Central America and in the Aleutian Islands; elsewhere they are separated by long distances, but nevertheless they would seem to have some connection with each other. Sometimes the line of volcanoes surrounding the Pacific is very narrow, as in Central America, and then again it broadens hundreds of miles, as in the western United States, where extinct volcanoes on the east edge of the belt are hundreds of miles from the ocean and distant from each other.

Within this great Pacific circle of volcanoes, twenty-five thousand miles in length, are many volcanic islands: the Ladrones, the Hawaiian Islands, with the famous Mauna Loa; the Galapagos, the Samoan Islands, as well as the Tonga and Fiji Archipelagoes, and many smaller groups. The coral islands may be also classed as volcanic, as they rest in great part on volcanic foundations.

Eastward from the circle around the Pacific, a branch belt extends through Sumatra and Java. On the broken isthmus which ages ago joined Asia and Australia are over one hundred volcanoes, many of which are constantly belching forth mud, lava, or ashes. This is the great focus of volcanic action of the earth.

Round nearly three sides of the Atlantic basin volcanic districts are scattered with some apparent symmetry. In the far north Hekla and nearly one score others separate the Atlantic from the Arctic Ocean. Stretching

From "Volcanoes of North America," by Israel C. Russell (The Macmillan Co.)



Sketch Map of the World Showing General Distribution of Volcanoes

from Iceland, from north to south an irregular submerged ridge bears the volcanic mountains of the Azores, the Cape Verde Islands, Ascension, St. Helena, and Tristan da Cunha. On the west edge of the Atlantic are the volcanoes of the West Indies; but north or south of the Antilles there is not a single volcano on the east coast of America. The volcanic belt of the Mediterranean shore is prolonged to the mountains of Armenia and western Arabia. There are said to be some volcanoes in Tibet and Manchuria, but the explorer has not yet located them.

Elisée Reclus has drawn attention to the fact that the great centers of volcanic action in the western and eastern hemispheres are at exactly opposite ends of the globe—are at antipodes to each other—and that these centers of activity are near the poles of flattening. They also flank, one on the west and one on the east, the immense circle around the Pacific.

Volcanoes may be roughly described as of two types—the expulsive and the explosive. Of the first, Hekla, in Iceland, Stromboli, and Mauna Loa in the Hawaiian Islands, are good examples. They pour forth masses of lava which flows like molasses. Of the second type are Vesuvius, Mont Pelée, the volcanoes of the West Indies, and those of the Andes and of Mexico; these eject the material andesite, and are more explosive than those ejecting the ropy lavas.

CAUSES OF VOLCANIC ACTION

Theories abound as to the cause of volcanic action, but of actual causes we know little. Science has no X rays to pierce into the bowels of the earth.

Lafcadio Hearn, in one of his interesting sketches of the French West Indies, published some years ago, tells the story of perhaps the only man who ever descended into the earth while it quaked. It seems that during a certain convulsion that shook and rent a certain island of the West Indies one man was thrown far down a fissure. He was unharmed, but his position, as he tumbled far down in the fissure, was not such as to inspire hope or a scientific study of what had happened or was happening. After some time passed there in the bowels of the earth, another convulsion shook and rent the ground. It tossed him up and up and out of the fissure and landed him unharmed on solid and firm ground; but when asked how it had all happened, the process of all this tossing, he could not explain. Science had lost its one chance of learning by personal observation what is happening beneath us.

Perhaps the most probable explanation of explosive eruptions of volcanoes is as follows:

The rocks deep beneath the surface are kept moist by the water that slowly seeps through. Probably the rocks contain from 3 to 20 per cent of water. The heat of the molten mass beneath the rocks gradually generates steam, and as time goes on more and more steam is generated. The pressure of this steam is constantly increasing until a time comes when the weight above can not hold in the expanding force of the steam. Like a boiler, the whole mass explodes with terrific fury. An earthquake may open a fissure which, by letting down water rapidly, will hasten the explosion; but it is doubtful if an earthquake can do more than this. Water entering by a fissure could hardly invade the vast area upheaved by an explosive eruption.

The Guatemalan earthquake of April probably timed the explosion of Mont Pelée and La Soufrière. It was the last straw; it brought the last ounce of pressure—one ounce more than the boiler could bear. The local earthquakes in Martinique and St. Vincent were the ruptures and tremors caused by the fettered steam.

Two other factors may assist this process: The shrinking of the earth, which allows the molten mass to rise through fissures and generate steam more rapidly, and the change of load at the surface, caused by deposition or degradation, which thus disturbs the law of equilibrium.

Of eruptions in general Professor Russell says:

"The cause of the rise of the molten rock in a volcano is still a matter of discussion. Certain geologists contend that steam is the sole motive power, while others consider that the lava is forced to the surface owing to pressure on the reservoir from which it comes. The view perhaps most favorably entertained at present in reference to the general nature of volcanic eruptions is that the rigid outer portion of the earth becomes fractured, owing principally to movements resulting from the shrinking of the cooling inner mass, and that the intensely hot material reached by the fissures, previously solid owing to pressure, becomes liquid when pressure is relieved, and is forced to the surface. As the molten material rises, it invades the water-charged rocks near the surface and acquires steam or the gases resulting from the decomposition of water, and a new force is added, which produces the most conspicuous and at times the most terrible phenomena accompanying eruptions.

"The recent volcanic outbreaks on Martinique and St. Vincent were eruptions of the explosive type The volcanoes have been dormant for years, and the lava in the summit portion of their conduits was cold and hard. Movements in the earth's crust caused a fresh ascent of lava from deep below the surface, the molten material came in contact with water in the rocks it invaded, and steam explosions resulted.

"These explosions were similar to what would happen if water should be poured on a mass of molten slag such as comes from an iron furnace."

SOME ERUPTIONS OF THE PAST

Prof. William M. Davis and Mr. William H. Snyder, in their excellent "Physical Geography" (Ginn & Co.), give a number of interesting instances of volcanic eruptions. I quote the following:

"Monte Nuovo (New Mountain) is a small volcano that was formed on the north side of the Gulf of Naples, in Italy, in 1538. Earthquakes occurred thereabouts for two years before the eruption, when in a week's time a cone was built up 440 feet high, half a mile in diameter at the base, and with a crater over 400 feet deep. Masses of lava 'as large as an ox' were shot into the air by the bursting of great bubbles of gas or steam that ascended through the lava in the vent. Finer ashes fell over the country for several miles around. The people of the neighboring villages fled in terror from their homes.

"A great eruption took place in Mexico in 1750, when the volcano Jorullo (pronounced Ho-rul-yo) was built on the central plateau, burying fertile fields of sugar cane and indigo. The outburst was preceded by earthquakes; the eruption continued half a year, building six cones and pouring out extensive lava flows. The highest cone, Jorullo, rose 700 feet above the plateau. The flows retained a perceptible heat for over 20 years.

"Many examples might be given of marine eruptions. In 1867 a shoal was discovered among the Tonga Islands of the Pacific (latitude 20° 20′ south, longitude 175° 20′ west), the surrounding sea floor being about 1,000 fathoms deep. In 1877 smoke was seen ascending from the sea surface over the shoals. In October, 1885, an island had been formed two miles long and 200 feet high. At this time a terrific eruption was in progress, enormous clouds of constantly changing form rising over the island. The shocks of the explosion were felt

on neighboring islands, and the sound was heard 200 miles away. As the island consisted chiefly of ashes, it has since then been rapidly consumed by the waves, and will soon disappear unless new eruptions occur.

"In northern California there is a cinder cone of remarkably perfect form and certainly of recent date, although there is no record of its eruption. The cone, built of loose ashes, is 2,000 feet in diameter at its base, and rises 640 feet to a circular rim enclosing a crater 240 feet deep. It is perfectly barren. Although of moderate height, its ascent is difficult, as the ashes slide under a man's weight. A stream of lava emerges near the base of the cone, and, flowing westward into a neighboring valley, forms a large field a mile wide and nearly three miles long. The surface of the field is so covered with great clinkery blocks of lava as to be almost impassable. It is still unweathered and barren. The edge of the field is a steep clinkery slope 100 feet high. It obstructs a stream from the south, which forms Snag Lake, so called from the dead trees still standing in it. The lake outlet runs north along the west edge of the lava. On all sides the surface of the country is covered with a layer of volcanic ashes and dust, six or more feet deep near the cone, thinner and finer farther away, yet recognizable at a distance of eight miles. From the size of trees growing on the ashes, it is estimated that the cinder cone was built about 200 years ago. The lava flow is younger, but none of the Indians or early settlers thereabouts (1845) observed its eruption."

G. H. G.

MAGNETIC DISTURBANCE CAUSED BY THE EXPLOSION OF MONT PELÉE

IN explosive violence the eruption of Mont Pelée was to Krakatoa but the bursting of a bubble. Krakatoa was heard distinctly 3,000 miles away; the sound of Mont Pelée penetrated only 200. Krakatoa sent its dust round the globe; the dust of Mont Pelée was carried less than 300 miles. But in one very important respect, the electrical phenomena accompanying the explosion, Mont Pelée apparently surpassed Krakatoa; *for the first time in the history of volcanic eruptions, so powerful electro-magnetic waves were shot out by a bursting volcano that magnetic needles 2,000 and 5,500 miles away were disturbed for many hours.*

Mr. O. H. Tittmann, Superintendent of the U. S. Coast and Geodetic Survey, reports that the magnetic needles at the Coast Survey magnetic observatories at Cheltenham, Maryland, at Baldwin, Kansas, and also in the Hawaiian Islands, were disturbed on the morning of May 8 at the time of the volcanic explosion at Pelée. The needles are very delicately suspended, and register automatically by photographic means the minutest variation in the direction and intensity of the earth's magnetic force. The magnetic disturbance began at the Cheltenham observatory at a time corresponding to 7.53, St. Pierre local mean time, and at the Baldwin observatory 7.55, St. Pierre time. Reports from St. Pierre state that the explosion of Mont Pelée occurred a few minutes before 8 o'clock in the morning. A clock in St. Pierre was stopped at 7.50 a. m. The magnetic disturbance was thus almost instantaneously recorded at the Survey observatories. The needles

were disturbed again on May 20, at the time of the second eruption of the mountain.

The disturbance of the magnetic needles was plainly due to magnetic effects, and was in no sense caused by purely mechanical vibrations. *It is the first instance that magnetic effects caused by eruptions of distant volcanoes have ever been recorded at magnetic observatories.* Mechanical vibrations of magnetic needles caused by earthquakes have been previously noted. For instance, the Guatemalan earthquake on April 18, 1902, caused a distinct mechanical vibration of the magnetic needles for at least one-half an hour, but no magnetic disturbance was registered. The distinct magnetic effect of the morning of May 8 pulled the magnetic needles aside from their usual direction for many hours.

Dr. L. A. Bauer, head of the magnetic work of the Survey, has not yet received information from the observatory at Sitka whether any magnetic disturbance was registered at this point at the same time, nor has he received information from foreign observatories. Until such information is received, of course we cannot state definitely that the remarkable magnetic disturbances registered on the mornings of May 8 and of May 20 at Cheltenham and Baldwin were due to the eruptions in the West Indies, but the very remarkable coincidence in time makes this conclusion probable.

THE NATIONAL GEOGRAPHIC SOCIETY EXPEDITION IN THE WEST INDIES

ON their arrival at Martinique the National Geographic Society party separated. Prof. Robert T. Hill remained in Martinique to examine Mont Pelée, while Prof. Israel C. Russell and Mr. C. E. Borchgrevink proceeded to St. Vincent to investigate conditions on that island. The expedition, having been authorized to enlarge their party, associated with them Dr. Thomas A. Jaggar, of Harvard University; Mr. George C. Curtis, of Cambridge, and Dr. Angelo Heilprin, of the Board of Managers of the National Geographic Society (President of the Philadelphia Geographical Society), who arrived at Martinique several days after the other scientists.

WORK OF PROFESSOR HILL

Mr. Hill embarked on a steamer and examined the coast as far north as Macouba Point, the north end of the island, making frequent landings. After landing at Le Precheur, a little village five miles north of St. Pierre, he walked through an area of active volcanism to the devastated city. Mr. Hill, according to the Associated Press dispatches from Fort de France, was the first man to set foot in the area of craters, fissures, and fumaroles. During this trip along the coast, in addition to his work of investigation, Mr. Hill rescued in his steamer many poor persons of Le Precheur, who had been tempted back to their homes by the temporary lull of Mont Pelée and had since found themselves in great danger.

On his return to Fort de France he issued a brief statement as to his observations which may be published in advance of his detailed report to the National Geographic Society, which will be printed in this Magazine.

"The zone of the catastrophe in Mar-

tinique forms an elongated oval, containing on land about eight square miles of destruction. This oval is partly over the sea. The land part is bounded by lines running from Le Precheur to the peak of Mont Pelée, thence curving around to Carbet. There were three well marked zones:

"First. A center of annihilation, in which all life, vegetable and animal, was utterly destroyed. The greater northern part of St. Pierre was in this zone.

"Second. A zone of singeing, blistering flame, which also was fatal to all life, killing all men and animals, burning the leaves on the trees, and scorching, but not utterly destroying, the trees themselves.

"Third. A large outer, non-destructive zone of ashes, wherein some vegetation was injured.

"The focus of annihilation was the new crater, midway between the sea and the peak of Mont Pelée, where now exists a new area of active volcanism, with hundreds of fumaroles, or miniature volcanoes.

"The new crater is now vomiting black, hot mud, which is falling into the sea. Both craters, the old and new, are active. Mushroom-shaped steam explosions constantly ascend from the old crater, while heavy ash-laden clouds float horizontally from the new crater. The old ejects steam, smoke, mud, pumice, and lapilli, but no molten lava.

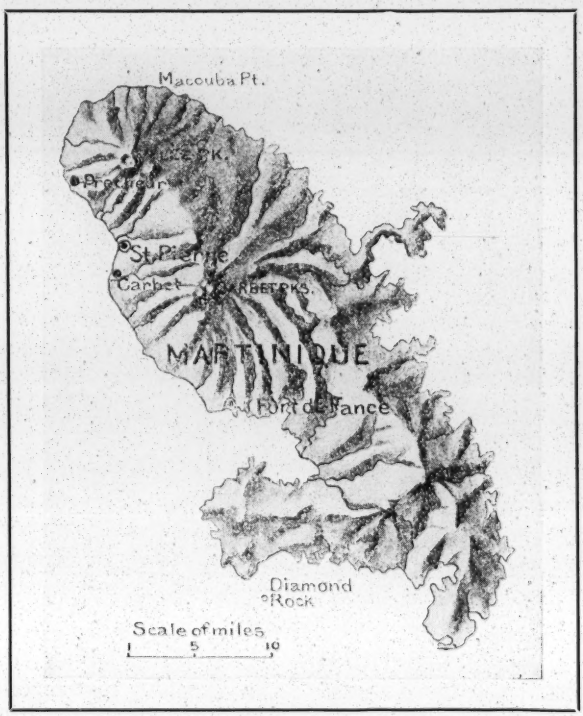
"The salient topography of the region is unaltered. The destruction of St. Pierre was due to the new crater. The explosion had great superficial force, acting in radial directions, as is evidenced by the dismounting and carrying for yards the guns in the battery on the hill south of St. Pierre and the statue of the Virgin in the same locality, and also by the condition of the ruined houses in St. Pierre.

"According to the testimony of some persons, there was an accompanying flame. Others think the incandescent cinders and the force of their ejection were sufficient to cause the destruction. This must be investigated. I am now following the nature of this hill."

On Monday, May 26, Mr. Hill started on horseback from Fort de France for Morne Rouge and Mont Pelée. He reached Morne Rouge safely Tuesday, where he succeeded in getting a number of photographs. A close approach to Mont Pelée was impossible, so he started back in a southerly direction. During the two nights he was camping out he made some important observations of volcanic action, and on his return issued the following statement:

"My attempt to examine the crater of Mont Pelée has been futile. I succeeded, however, in getting very close to Morne Rouge. At 7 o'clock on Monday evening I witnessed from a point near the ruins of St. Pierre a frightful explosion from Mont Pelée, and noted the accompanying phenomena. While these eruptions continue no sane man should attempt an ascent to the crater of the volcano. Following the salvos of detonations from the mountain gigantic mushroom-shaped columns of smoke and cinders ascended into the clear, starlit sky, and then spread in a vast black sheet to the south and directly over my head. Through this sheet, which extended a distance of 10 miles from the crater, vivid and awful lightning-like bolts flashed with alarming frequency. They followed distinct paths of ignition, but were different from lightning, in that the bolts were horizontal and not perpendicular. This is indisputable evidence of the explosive oxidation of the gases after they left the crater. This is a most important observation, and it explains in part the awful catastrophe. This phenomenon is entirely new in volcanic history.

"I took many photographs, but do not hesitate to acknowledge that I was terrified; but I was not the only person



Sketch Map of Martinique Showing Mountainous Character of the Island

Diamond Rock is reported by passing vessels to be smoking

so frightened. Two newspaper correspondents who were close to Morne Rouge some hours before me became scared, ran three miles down the mountain, and hastened into Fort de France.

"Nearly all the phenomena of these volcanic outbreaks are new to science, and many of them have not yet been explained. The volcano is still intensely active, and I cannot make any predictions as to what it will do."

THE ASCENT OF MONT PELÉE BY PROF. ANGELO HEILPRIN

Associated Press dispatches from Martinique, under date of May 31, announced that Professor Heilprin had succeeded in climbing to the top of the crater of Mont Pelée. The dispatch is quoted as follows:

"The National Geographic Society has scored a great triumph through its representative here, Prof. Angelo Heilprin, who this morning with three guides ascended to the top of the crater on the summit of Mont Pelée. Professor Heilprin is also president of the Philadelphia Geographical Society.

"The expedition left Fort de France last Thursday, May 29, at noon. Friday was spent in studying the newly formed craters on the north flank of the mountain. Saturday morning Professor Heilprin determined to attempt the ascent to the top of the crater, and with this purpose in view he set out at five o'clock.

"The volcano was very active, but amid a thousand dangers Professor Heilprin reached the summit and looked

down into the huge crater. Here he spent some time in taking careful observations. He saw a huge cinder cone in the center of the crater. The opening of the crater itself is a vast crevice 500 feet long and 150 feet wide.

"While Professor Heilprin was on the summit of the volcano several violent explosions of steam and cinder-laden vapor took place, and again and again his life was in danger. Ashes fell about him in such quantities at times as to completely obscure his vision. One particularly violent explosion of mud covered the Professor from head to foot with the hideous viscid and semi-solid matter. He still persisted in his study and observations, however, and twice more was showered with mud. He learned, as had been suspected, that there were three separate vents through which steam issued.

"Professor Heilprin's journey down the side of the mountain was fully as perilous as the ascent. Mont Pelée seemed to resent the intrusion of a puny human being into her most awful precincts, and belched out huge volumes of steam, ashes, and boiling hot mud.

"The Professor made the important discovery that the crater at the head of the River Fallaise has synchronous eruptions with the crater at the summit of the volcano, and that it ejects precisely the same matter at such times."

ASCENT OF MOUNT SOUFRIÈRE

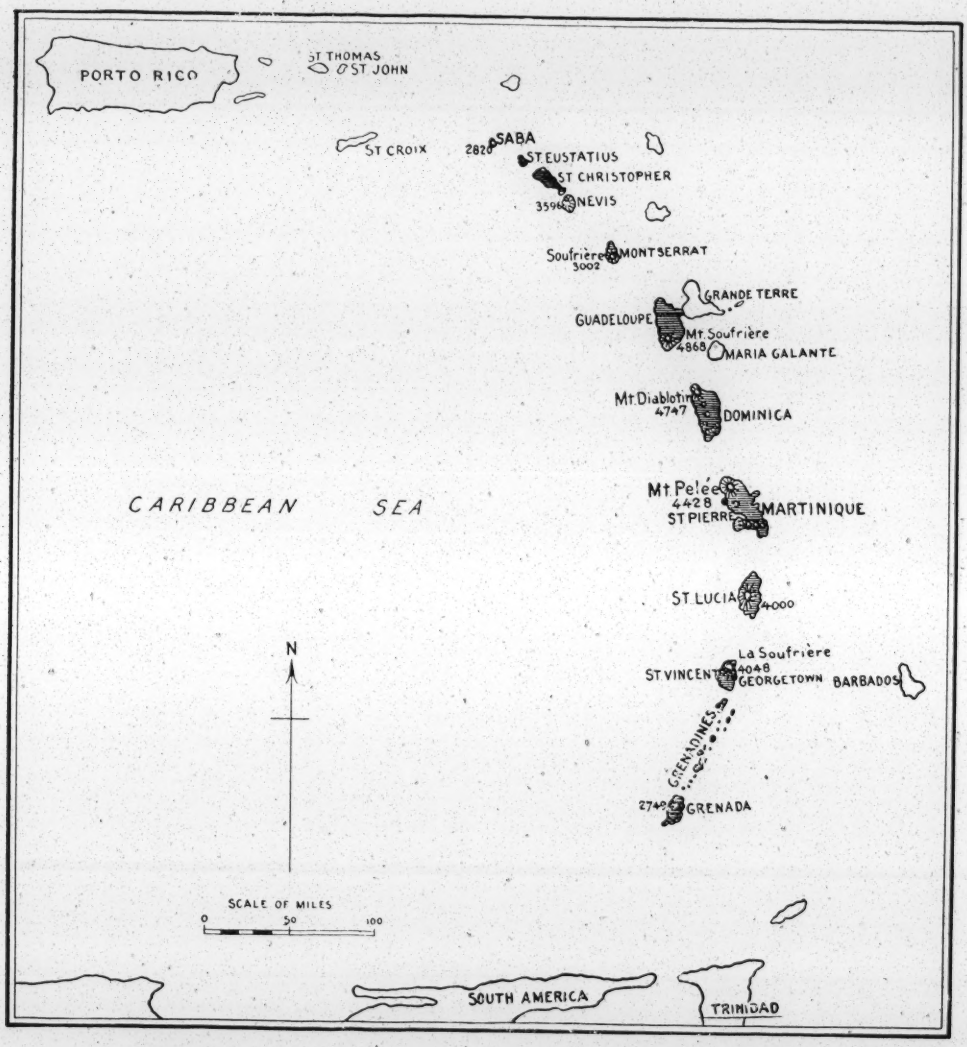
On May 31 a party consisting of Professor Jaggar, of Harvard University; Dr. Hovey, of the American Museum of Natural History of New York, and Mr. George C. Curtis ascended to the summit of Soufrière from the western side. Messrs. Jaggar and Curtis are working under the auspices of the National Geographic Society. Mr. Hovey is also a member of the Society, but represented the American Museum of Natural History. The cabled report of their achievement is as follows:

"The ascent was exceedingly difficult, owing to the mud that covered the mountain side, but the ground was cold. After a tiresome scramble up the slippery hill, the rim of the old crater was reached about midday. There was no trace whatever of vegetation, but there had been no change in the topographical outlines of the mountain on that side, and the old crater retained its tragic beauty. The great mass of water that formerly lay serenely about 500 feet below the rim of the crater had disappeared, and the crater appeared to be a dreadful chasm over 2,000 feet deep. With the aid of a glass water was made out at the bottom of this abyss.

"The party did not venture across the summit of the Soufrière to inspect the new crater, which was then emitting a little vapor, for the ground in that direction looked to be dangerous.

"Apparently the ridge of the mountain, called 'The Saddle,' was intact, although the old crater seemed of larger circumference than before the recent eruption. At the western base of the Soufrière a subsidence of a depth of 100 feet occurred for an area of a square mile. The bank of volcanic dust that prevents the sea encroaching farther inland at Wallibou is being gradually washed away. The lava beds on the eastern side of the Soufrière continue to emit steam, despite the protracted and heavy rainfall that has occurred. The eruption, the scientists say, was obviously more violent on the eastern side of the mountain, where the new crater is located, than on the western side."

VOLCANIC ISLANDS OF WEST INDIES



Map Showing the Volcanic Islands of the West Indies

The islands of volcanic origin, those which have been thrust above the sea by plutonic energy, are shaded. The others are of oceanic origin, formed of the calcareous remains of marine life. By a strange freak of nature Guadeloupe unites the two formations, the eastern half of the island (Grande Terre) being of marine origin, while the western half, joined to the other by a narrow isthmus, is volcanic, like Martinique. With the exception of Barbados, the volcanic islands have been the more prosperous and important.

LAFCADIO HEARN ON THE ISLAND AND PEOPLE OF MARTINIQUE*

THE first attempt to colonize Martinique was abandoned almost as soon as begun, because the leaders of the expedition found the country "too rugged and too mountainous" and were "terrified by the prodigious number of serpents which covered its soil." Landing on June 25, 1635, Olive and Duplessis left the island after a few hours exploration, or, rather, observation, and made sail for Guadeloupe, according to the quaint and most veracious history of Père Dutertre, of the order of Friars-Preachers. (Martinique was settled by the French in 1665, and with the exception of 22 years, 1794–1816, when the English held it, has been a French colony ever since. It sends a senator and two deputies to the National Assembly at Paris.)

No description could give the reader a just idea of what Martinique is, configuratively, so well as the simple statement that, although less than fifty miles in extreme length, and less than twenty in average breadth, there are upward of *four hundred mountains* in this little island, or of what at least might be termed mountains elsewhere. These again are divided and interpeaked, and bear hillocks on their slopes, and the lowest hillock in Martinique is fifty meters high. Some of the peaks are said to be totally inaccessible; many more are so on one or two or even three sides. Ninety-one only of the principal mountains have been named.

MONT PELÉE

Is the great volcano dead? Nobody knows. Less than forty years ago it rained ashes over the roofs of St. Pierre; within twenty years it had uttered mutterings. For the moment it appears to be asleep, and the clouds have dripped into the cup of its highest crater until it has become a lake several hundreds of yards in circumference. The crater occupied by this lake, called L'ètang or the Pool, has never been active within human memory. There are others—difficult and dangerous to visit because opening on the side of a tremendous gorge—and it was one of these, no doubt, which has always been called La Souffrière, which rained ashes over the city in 1851.

The explosion was almost concomitant with the last of a series of earthquake shocks, which began in the middle of May and ended in the first week in August—all much more severe in Guadeloupe than in Martinique. In the village Au Prêcheur, lying at the foot of the western slope of Pelée, the people had been for some time complaining of an oppressive stench of sulphur, or, as the chemists declared it, sulphuretted hydrogen, when on the 4th of August much trepidation was caused by a long and appalling noise from the mountain, a noise compared by planters on the neighboring slopes to the hollow roaring made by a packet blowing off steam, but infinitely louder. These sounds continued through intervals until the following night, sometimes deepening into a rumble like thunder. At 11 p. m. the noise was terrible enough to fill all St. Pierre with alarm, and on the morning of the 6th the city presented an unwonted aspect, compared by Creoles who had lived abroad to the effect of a great hoar-frost.

A committee appointed to make an investigation and prepare an official report found that a number of rents had either been newly formed, or suddenly become active, in the flank of the moun-

*From "Two Years in the French West Indies," Lafcadio Hearn, Harper & Bros.

tain. These were all situated in the immense gorge sloping westward from that point now known as the Morne de la Croix. It was satisfactorily ascertained that the main force of the explosion had been exerted within a perimeter of about 1,000 yards; that various hot springs had suddenly gushed out, and—the temperature of the least warm being about 57 degrees Réaumur (116 degrees Fahrenheit)—that there was no change in the configuration of the mountain, and that the terrific sounds had been produced only by the violent outrush of vapor and ashes from some of the rents. In hope of allaying the general alarm, a Creole priest climbed the summit of the volcano and there planted the great cross which gives the height its name and still remains to commemorate the event.

ST. PIERRE

St. Pierre is the quaintest, queerest, and the prettiest withal among West Indian cities—all stone-built and stone-flagged, with very narrow streets, wooden or zinc awnings, and peaked roofs of red tile, pierced by gabled dormers. Most of the buildings are painted in a clear, yellow tone, which contrasts delightfully with the burning blue ribbon of tropical sky above, and no street is absolutely level; nearly all of them climb hills, descend into hollows, curve, twist, describe sudden angles. There is everywhere a loud murmur of running water, pouring through the deep gutters contrived between the paved thoroughfare and the absurd little sidewalks, varying in width from one to three feet. The architecture is that of the seventeenth century, and reminds one of the antiquated French quarter of New Orleans. All the tints, the forms, the vistas, would seem to have been especially selected or designed for aquarelle studies. The windows are frameless openings without glass; some have iron bars; all have heavy wooden shutters with movable slats, through which light and air can enter.

THE PEOPLE

Fantastic, astonishing—a population of the "Arabian Nights." It is many-colored, but the general dominant tint is yellow. . . . Straight as palms, and supple and tall, these colored women and men impress one powerfully by their dignified carriage and easy elegance of movement. All, or nearly all, are without shoes. . . . Perhaps the most novel impression of all is that produced by the singularity and brilliancy of certain of the women's costumes. Some of these fashions suggest the Orient; they offer beautiful audacities of color contrast, and the full-dress coiffure, above all, is most striking. It is an immense Madras handkerchief, which is folded about the head with admirable art, like a turban, one bright end, pushed through at the top in front, being left sticking up like a plume. Then this turban, always full of bright canary color, is fastened with golden brooches, one in front and one at either side. As for the remainder of the dress, it is simple enough—an embroidered, low-cut chemise with sleeves; a skirt or jupe, very long behind, but caught up and fastened in front below the breasts, so as to bring the hem everywhere to a level with the end of the long chemise, and, finally, a foulard or silken kerchief, thrown over the shoulders. These jupes and foulards, however, are exquisite in pattern and color—bright crimson, bright yellow, bright blue, bright green, lilac, violet, rose, sometimes mingled in plaidings or checkerings or stripings; black with orange, sky-blue with purple; and whatever be the colors of the costume, which vary astonishingly, the coiffure must be yellow—brilliant, flashing yellow. The turban is certain to have yellow stripes or yellow squares. To this display add the effect of costly and curious jewelry, immense earrings,

each pendant being formed of five gold cylinders joined together, cylinders sometimes two inches long and an inch at least in circumference ; a necklace of one or many rows of large, hollow gold beads, called *collier-choux*.

But few are thus richly attired ; the greater number of the women, carrying burdens on their heads, peddling vegetables, cakes, fruit, ready-cooked food, from door to door, are very simply dressed in a single plain robe of vivid colors (*douillette*), reaching from neck to feet, and made with a train, but generally girded well up so as to sit close to the figure and leave the lower limbs partly bare and perfectly free. These women can walk all day long up and down hill in the hot sun, without shoes, carrying loads of from one hundred to one hundred and fifty pounds on their heads, and if their little stock sometimes fails to come up to the accustomed weight, stones are added to make it heavy enough. With the women the load is very seldom steadied with the hand. The head remains almost motionless, but the black, quick, piercing eyes flash into every window and doorway to watch for a customer's signal. These women also carry the produce across mountain from plantation to seaport.

GEOGRAPHIC NOTES

THE CARIBS

WHEN Columbus landed at Haiti on his first voyage he heard much of the war-like people to the south who ravaged the more peaceful natives of Haiti and the northern islands. But it was not until the end of 1493, on his second voyage of discovery, that he landed at Guadeloupe, the stronghold of the Caribs, and first beheld this cannibal race. Washington Irving, in his "Life and Voyages of Christopher Columbus," describes the horror of the Spaniards when they found human limbs suspended from the beams of the houses as if curing for provisions. "The head of a young man, recently killed, was yet bleeding. Some parts of his body were roasting before the fire ; others boiling with the flesh of geese and parrots."

The whole archipelago, extending from Porto Rico to Tobago, was under the sway of the Caribs. They were a warlike and unyielding race, quite different from the feeble nations around them. Of the thousands of these fierce people who dominated the Caribbees four centuries ago, only a few hundred descendants remain. In the northern part of St. Vincent a few Caribs are still left, and in Dominica are a few others.

The Caribs were also found in Guiana and along the Lower Orinoco. Spain condemned them to slavery, but they were not much molested by her because of their fierce character. In later years the English and French fought long and bloody wars with them. St. Vincent became their last stronghold. In 1796 England transported 5,000 Caribs from St. Vincent to the island of Ruaton, whence many of them passed to Honduras and Nicaragua.

THE RUSSIAN TIBET EXPEDITION

IN the spring of 1899 the Russian Geographical Society sent an expedition to central Asia and Tibet under command of Captain P. K. Kozloff. The Czar had granted the money for the purpose. Captain Kozloff set out with a party of 38, including several scientists. During the years 1899, 1900,

and 1901 Captain Kozloff was exploring the desert of Gobi, Mongolia, and Tibet. He returned to St. Petersburg in January, 1902. The *Geographical Journal* for May contains a detailed account of the very important results of the expedition, which Captain Kozloff summarizes as follows:

"We have thoroughly explored the Chinese or Mongolian Altai, the central Gobi, and that portion of inner Tibet which is known as 'Kam.' The Altai has been explored all along its northern and southern foot, and has been crossed several times. The desert of the Gobi was crossed along four different routes in the winter, provisions of ice or snow being taken during these crossings. In eastern Tsaidam, at the northern foot of Tibet, a depot of the collections and the provisions was organized, and the camels were left, the journey in Tibet being only possible with oxen. At this depot a meteorological station was organized, as had been recommended by the late General Tillo. Four men, under Sergeant Ivanoff, were left at the station, and the conduct of the meteorological observations was left to Muravioff, who had received the necessary preliminary training. The Tsaidam meteorological station has thus worked for fifteen months without interruption, the records of the instruments being taken thrice a day and once every three months every hour for twenty-four hours in succession. This was the first time that such work was done in central Asia, and the observations of the Tsaidam station will give a solid basis for calculating out altitudes in Tibet. It was also the first time that a canvas boat was used for the exploration of lakes in central Asia, their depths and their flora and fauna.

"We brought back with us: (1) about 8,000 miles of survey; (2) the positions of forty localities determined astronomically; (3) geographical, historical, and ethnographical, as also commercial information about the regions visited; (4) more than 400 photographs; (5) meteorological observations which were made regularly every day, and (6) rich natural history collections—that is, about 1,200 geological specimens, nearly 1,400 species of plants (over 30,000 specimens), and the following zoölogical specimens: 300 skins of mammals, 10 skeletons, 1,500 birds, 500 fishes and reptiles, and 30,000 insects. All these collections have already reached St. Petersburg in good order, have been arranged, and are already in the hands of specialists and different bodies."

TOPOGRAPHIC SURVEY OF THE UNITED STATES

THE extent to which the topographic mapping of the United States has been conducted by the United States Geological Survey, including the progress made during the fiscal year ending June 30, 1901, appears in a comprehensive statement by Director Charles D. Walcott in his Twenty-second Annual Report, which has just been issued. Since its organization, the United States Geological Survey has been engaged in making a topographic survey and map of the United States. The unit of survey is a quadrangle 15′, 30′, or 1° in extent each way. The unit of publication is an atlas sheet 16½ inches wide by 20 inches high, and each sheet is a topographic map of one of the above areas. The maps are engraved on copper and printed from stone, in three colors. The cultural features, such as roads, railroads, cities, towns, etc., as well as all lettering, are in black; all water features are printed in blue, while the hill features are shown by brown contour lines. Maps of limited areas, economically important, also maps of the larger cities and their suburban districts, are sometimes published which are not in con-

formity with the general scheme outlined above. These are known as *special maps*. By act of Congress, the maps are disposed of by sale, those of standard size at 5 cents a sheet; for 100 or more in one order the maps of standard size are listed at 2 cents each.

The Director's report shows that, during the year which it covers, 35,123 square miles were covered by detailed topographic mapping, distributed through thirty-two states and territories, and that 12,407 miles of level were run and 1,338 permanent bench marks were established, these bench marks being iron posts, bronze or aluminum tablets, or copper or aluminum plugs. In connection with this work, primary azimuth observations were made at four triangulation stations, 37 meridian lines were established, 271 triangulation stations were occupied, and 2,088 miles of primary traverse were run. In connection with the surveys in Alaska, about 6,500 square miles were mapped topographically, thus opening up many new regions, some of which were before entirely unknown. In addition to the mapping, about 150 linear miles of stadia traverse and 274 linear miles of reconnaissance traverse were run. With reference to the surveys of the forest reserves, 23 miles boundary of the Black Hills Reserve, and 109 miles of the boundary of the Bighorn Reserve were surveyed and marked. The completion of the topographic work of the year 1900–1901 makes a total, with that previously done, of 866,847 square miles of the United States which have been fully surveyed and mapped, or 29 per cent of the entire area of the country.

For purposes of administration the territory of the country has been divided into five sections—the Forest Reserves section, Mr. Henry Gannett, geographer in charge; the Atlantic section, the work of which is controlled by Mr. H. M. Wilson, geographer in charge; the central section, with Mr. John H. Renshawe, geographer in charge; the Rocky Mountain section, with Mr. E. M. Douglas, geographer in charge, and the Pacific section, under the direction of Mr. Richard U. Goode, geographer.

Within the last few years one of the features of the work of the topographic branch of the Geological Survey has been the coöperative arrangements made between the Survey and various states, by which certain sums were appropriated by the state legislatures, which were duplicated by the Federal bureau, the latter also furnishing the engineers for the accomplishment of the work. Arrangements of this character were of advantage to the states, as they insured the publication of detailed topographic maps much more rapidly than would otherwise have been the case, the mapping being promptly followed by investigations of mineral water and timber resources. Coöperative arrangements of this nature, as noted by the report, were made with five states during the year, $19,500 being allotted by the State Engineer and Surveyor of New York; $18,000 by the State Survey Commission of Pennsylvania; $2,500 by the State Survey Commission of Maine; $5,000 by the State Geologist of Maryland, and $1,000 by the State Geologist of Alabama. The above amounts were all appropriations made by the states mentioned for coöperation with the Geological Survey. In addition, the state legislature of Ohio appropriated $25,000 to be available February 15, 1901, but no detailed mapping was commenced prior to the beginning of the usual field season.

NATIONAL GEOGRAPHIC SOCIETY NOTES

ISRAEL C. RUSSELL, Professor of Geology in the University of Michigan, Ann Arbor, has been elected a member of the Board of Managers of

the National Geographic Society, to fill the vacancy caused by the resignation of Prof. W. B. Powell. Professor Russell headed the expeditions sent by the Society some years ago to explore and ascend Mount St. Elias. He is the author of "Lakes of North America," "Glaciers of North America," "Volcanoes of North America," and many pamphlets and government reports.

Dr. Israel C. Russell

Member of the National Geographic Society Expedition to the West Indies

Gen. A. W. Greely, U. S. Army, has accepted the chairmanship of the Committee on the Eighth International Geographical Congress, which will meet in 1904, in Washington, under the auspices of the National Geographic Society. General Greely represented the National Geographic Society and the United States Government at the Geographical Congress at Berlin in 1899, and at the Congress in London in 1895.

In addition to the three members of the National Geographic Society Expedition, Messrs. Russell, Hill, and Borchgrevink, there sailed on the *Dixie* for Martinique May 14 six other members of the National Geographic Society: Mr. George Kennan, the noted traveler and author; Dr. E. O. Hovey, of the American Museum of Natural History; Prof. Thomas A. Jaggar, of Harvard University; Mr. George C. Curtis, of Boston, the well-known maker of land models; Mr. Robert Dunn, of New York, who has done considerable work among the Wrangell group of mountains, Alaska, and Mr. August F. Jaccaci, Art Editor of *McClure's Magazine*.

MOUNT BLACKBURN

TRAVELERS returning from Alaska have reported that Mount Blackburn, of the Wrangell group, in the southeastern part of the territory, was in active eruption in April. It is a lofty mountain, reaching to a height of 16,140 feet. Mr. Arthur C. Spencer, of the U. S. Geological Survey, who explored the mountain in 1900, states that at the time of his visit it could hardly have been called a volcano, extinct or alive, and he questions the report of its recent activity. Mount Blackburn is a rugged mass of limestone and various types of igneous rocks The lesser mountains around Blackburn are covered with volcanic material to a depth of several hundred feet, probably ejected from an ancient crater on Mount Blackburn. The top of the volcano had been worn away by erosion until it seemed highly improbable that it would ever come to life.

ST. VINCENT

THE little island of St. Vincent is 17 miles long and about 10 miles wide. On its area of 121 square miles is a population of nearly 50,000, who live for the most part on the southern

half of the island. At one time St. Vincent was the scene of much prosperity and considerable enterprise, but the sugar industry which gave it success is almost dead. One writer, comparing the four most ideal islands of the Caribbees—Guadeloupe, Dominica, Martinique, and St. Vincent—says: "The first is grand and gloomy; the second is somber in its mountains, but breaks out into smiling tracts of cultivated land; the third combines the features of the first two and adds the element of a large and picturesque population, while St. Vincent has all the natural wonders and beauties of the other three and a certain air of delicate culture which is entirely its own."

The disaster of May, 1902, which destroyed 2,000 people on the island, is not the first that has befallen St. Vincent. Defoe has written a graphic description of a fearful eruption of the great crater in 1718.* In 1812 a great volcanic upheaval wrought fearful havoc, destroying thousands of lives. This eruption probably terminated the volcanic and seismic disturbances which for two years had been disturbing the region of the Caribbean Sea.

St. Vincent is a colony of Great Britain. Grenada, the Grenadines, Barbados, St. Lucia, Dominica, Montserrat, Nevis, and St. Christopher are also British property. Martinique and Guadeloupe fly the French flag, while Saba and St. Eustatius belong to the Dutch.

CHILE-ARGENTINA BOUNDARY DISPUTE

THE governments of Chile and Argentina have signed an agreement which will probably end the long-standing dispute between the two countries. The principal points of the agreement are: (1) a treaty of general arbitration to last ten years; the arbitrators shall be two foreign powers, of which Great Britain shall be one; (2) that each nation shall remain neutral in all questions now pending with other countries; (3) that the armaments of each republic shall be placed on an equal footing. Landmarks are to be placed on the boundary as it is determined by a technical commission appointed by the arbitrator.

* Defoe's account of the eruption of 1718 was published in *Mist's Journal* on July 5, 1718. It was republished in the "Life and Newly Discovered Writings of Daniel Defoe," London, 1869, and in the New York *Evening Post* May 31, 1902.

TOPOGRAPHIC MAPS

AMONG the recent atlas sheets reissued by the United States Geological Survey is the Ellis, Kansas, sheet. The map represents a rectangular section about 27½ by 35 miles, just west of the center of the state, showing parts of Treco, Ellis, Rush, and Ness counties.

Another reprint issued by the Survey is the map known as the Huntersville sheet, which covers a portion of southeastern West Virginia near the state line, including the country adjacent to the towns of Huntersville and Addison.

FELLOWS OF THE NATIONAL GEOGRAPHIC SOCIETY

AT a regular meeting of the National Geographic Society, May 16, an important change in the by-laws of the Society was unanimously adopted. It was decided to institute a class of "fellows" in the Society. This class of "fellows" is to be strictly limited to persons actively engaged in geographic work and who have attained distinction for their achievements in geographic science. By vote of the Society the election of "fellows" is vested in the Board of Managers. No elections have yet been made, and none will be made before the fall of 1902.

GUSTAVE HERRLE

GUSTAVE HERRLE, whose death occurred in Washington, D. C., on April 16, 1902, exercised a notable influence in American geographical work. He was born in Wels, Austria, in 1843, and was educated in the Polytechnic School of Tuln for the career of a military engineer. In 1864 he joined his fortunes with those of Maximilian, Archduke of Austria, in the establishment of an empire in Mexico, and, in 1867, upon the fall of the Mexican Empire, he came to the United States, and was engaged for some years, under the direction of the late General Gilmore, in the construction of the harbor fortifications of New York.

In 1872 he became identified with the work of chart construction in the United States Hydrographic Office, and for many years invested his position at the head of the cartographic draftsmen of that office with a rare combination of knowledge and skill and diligence which, by enabling him to impress his character upon the marine hydrographic charts of the Navy Department, has served to elevate American cartography, and has made him a contributor of uncommon importance in the production of the independent resources of the people of the United States for conducting navigation beyond their own shores.

G. W. LITTLEHALES.

Crater Lake, Oregon.—Glittering snowfields and vast glaciers now cover the summits of the mighty volcanic mountains of the western United States—Mt. Shasta (14,350 feet), Mt. Rainier (14,525 feet), Mt. Hood (11,225 feet), and other noble peaks. One of the most remarkable of these extinct volcanoes is the well-known Mt. Mazama, in Oregon. The crater of Mt. Mazama is now occupied by a lake five to six miles in diameter. The lake is 6,239 feet above the sea, is 1,975 feet deep, and surrounded by almost vertical walls towering 900 to 2,200 feet. This is the only crater lake in the United States. An illustrated description of the lake, by J. S. Diller, was published in this Magazine, Vol. VIII, No. 2.

The Royal Geographical Society has founded a gold medal for geographical research, the Victoria medal, in honor of Queen Victoria, who was for many years patron of the society. The first award has been made to Mr. E. G. Ravenstein for his excellent work in cartography and in special recognition of his map of East Central Africa.

The Geographical Society of Philadelphia has awarded the Kane medal for this year to Lieut. Robert E. Peary for his achievements in Greenland in 1900. The medal was received by Mrs. Peary at the annual meeting of the Society, May 7.

GEOGRAPHIC LITERATURE

Finland: Its Public and Private Economy. By N. C. Fredricksen. 8vo, pp. xi + 306, with 5 maps. London: Edwin Arnold. 1902.

The table of contents of this book suggests a compendium of information concerning this little-known country, and between its covers much information is contained, but it is not of the sort which the average reader wants or expects. Such basic facts as area and population are conspicuous by their omission. Much is said in detail about the agricultural industry, but nothing which will enable the reader to measure its importance. Much space is devoted

to forestry, but after reading this chapter, one has only a confused and indefinite idea of the extent and value of the Finnish forests. The same indefiniteness characterizes the chapter on the foreign trade of the country. There is vastly more information concerning Finland in four pages of the *Statesman's Year-book* than in this entire work.

The Earth's Beginning. By Sir Robert Stawell Ball. With four colored plates and numerous illustrations. Pp. 384. New York: D. Appleton & Co.

In his preface to the book Sir Robert Ball states that his aim has been to give "a popular exposition of that splendid branch of astronomy which treats of the evolution of the earth, the planets, and the sun from fire-mist." The author has been successful in his object and has written a book that will be widely and profitably read at the present time, when the whole world is so deeply interested in the facts of the earth. In clear and graphic description of abstruse scientific theories Sir Robert Ball is a master. Some of the chapter headings are: "The Fire-mist," "Nebulæ, Apparent and Real," "Earthquakes and Volcanoes," "The Unity of Material in the Heavens and the Earth."

The Statesman's Year-book for 1902. Edited by J. Scott Keltie, assisted by I. P. A. Renwick. With eight maps. Pp. 1332. New York and London: The Macmillan Company. $3, net.

The latest edition of this indispensable year-book contains much new data. Within the year censuses have been taken of the British Empire and of many countries. All the new information thus acquired has been included in the volume. A valuable feature of the Year-book for 1902 is a series of maps and charts showing the density of population of Europe in 1901, the comparative growth of population of countries and of cities during the nineteenth century, the Uganda Railway and projected railways in Africa, etc. One map, that of the region of the proposed Nicaragua Canal, may be rightly criticised for incompleteness, as it fails to show the volcanoes, extinct or alive, in the Nicaragua region.

A Geological Study of the Fox Islands, Maine. By Geo. O. Smith. Colby College Bulletin, vol. ii, no. 1, April, 1902. Paper, $0.50; cloth, $0.75.

Summer visitors to the coast of Maine will find Dr. Smith's little study of North Haven and Vinal Haven Islands an interesting companion to consult. On the islands they will find the seat of an ancient volcano, with its lavas and tuffs still well enough preserved to be recognizable. In the book they may learn how to unravel the history of the islands from the rocks, and may discover the cause of their peculiar and interesting topography. The text is accompanied by a geological map of the Fox Island group.

First Across the Continent—The story of the Exploring Expedition of Lewis and Clarke in 1803-4-5. By Noah Brooks. 8vo, pp. xii + 364, map and 24 cuts. New York: Chas. Scribner's Sons. 1901.

This is a popular narrative of the well-known expedition across the continent, which gave us our first authentic information concerning its western part. It is largely composed of extracts from the journal of the explorers, supplemented and tied together by the author. The story of this remarkable expedition, though often told, never loses its fresh interest and romance, and Mr. Brooks' book will be welcomed by thousands of readers.

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